

[illegible]

- | | |
|------------|-----------------------------|
| E16 | Product/component/test step |
| | Vehicle/engine |



One-page section

- C6

A1

Trouble-shooting program



1. Special features

Vehicle, VOLVO 740, 1984 → Engine B200E, B230E,
with:

Trigger box	0 227 100 124 (with current limitation)
Ignition coil	0 221 118 351
EZ-K control unit	0 261 201 009 Engine B230 E
EZ-K control unit	0 261 201 010 Engine B200 E

2. Test specifications

Ignition coil, primary	0.6...1.0Ω	B17
Ignition coil, secondary	6.4...11.1 kΩ	
Dwell angle at cranking speed	27...33%	B19
Basic ignition timing at	12+ 1° BTDC 750...1000 min ⁻¹	B23 ↓ C4
Boiling-protection switch	> approx 103° C approx 0 Ω < approx 103° C approx ∞ Ω	C5
Spark advance at idle (Boiling-protection switch jumped)	23...27° BTDC	C9
Knock sensor "OLD"	270 ... 330 kΩ	C11 ↓ C16
Knock sensor "NEW"	---	
Tightening torque:		
Knock sensor "OLD"	11 ... 15 Nm	
Knock sensor "NEW"	15 ... 25 Nm	



Test values (cont'd.)

Voltage to control unit	12 ... 14 V	C19
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Voltage to ignition coil	≥ 10 V	
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Primary voltage at idle	295 ... 365 V	C21
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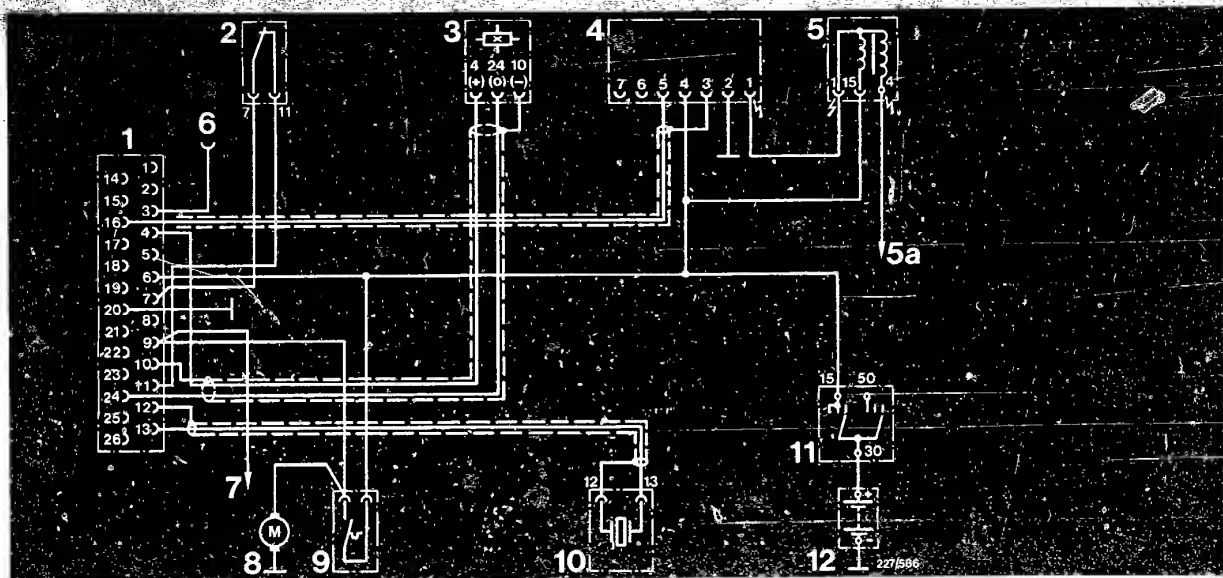
Voltage to magnetic pulse generator with ignition on	≥ 10 V	D7
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See auto data test values for setting values for idle speed, exhaust, valve clearance, etc.

A3

Test values
Volvo





Danger arrows: Warning: 400 V ... 25 kV

- 1 = EZ-K control unit
- 2 = Microswitch
- 3 = Ignition distributor
- 4 = Trigger box

- 5 = Ignition coil
- 5a = To ignition distributor
- 6 = Diagnostic connection
- 7 = To refrigerant compressor pressure monitor

- 8 = Fan motor
- 9 = Boiling-protection switch) only vehicles with air conditioner and tropics radiator
- 10 = Knock sensor
- 11 = Ignition/starting switch
- 12 = Battery

3. Electrical terminal diagram

A4

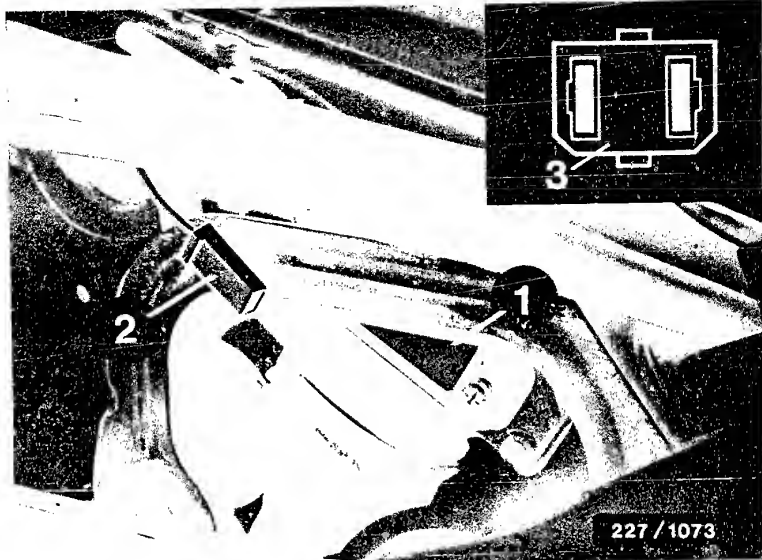
Electrical terminal diagram
Volvo



A5

Electrical terminal diagram
Volvo





- 1 = Trigger box 2 = Diagnostic connection, "OLD" (1-pin)
 3 = Diagnostic connection, "NEW" (2-pin)

4. Component locations

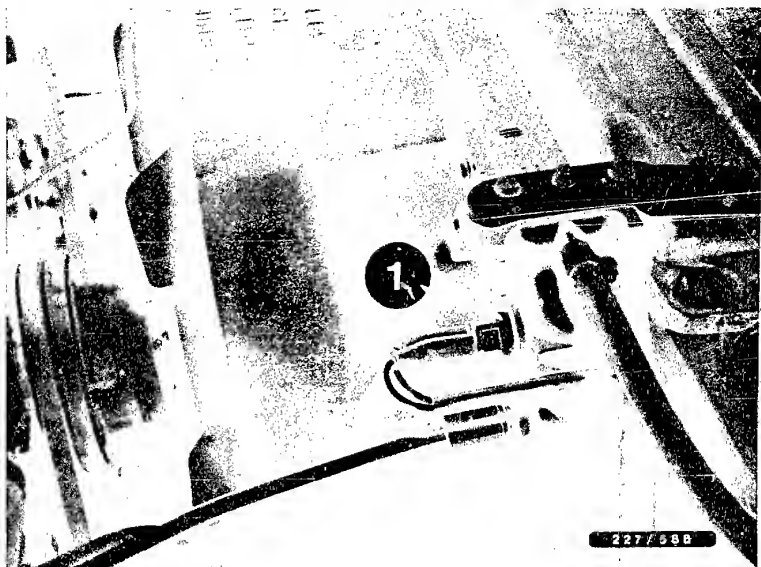
The control unit is mounted on a heat sink inside the engine compartment (near left-hand wheel well).

The diagnostic connector is located on the wiring harness.

A6

Installation position of components
 Volvo





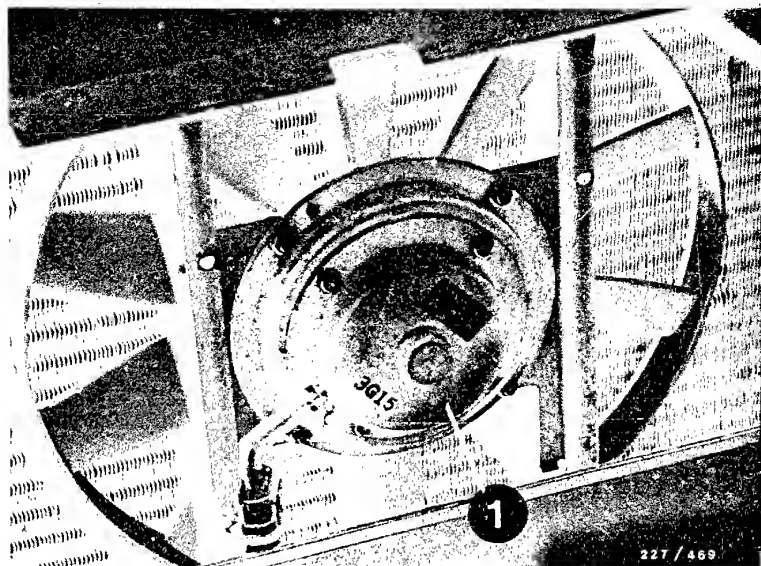
1 = Boiling-protection switch

Installed only on vehicle with air conditioner and
tropics radiator.

A7

Installation position of components
Volvo





1 = Fan motor (boiling-protection device)

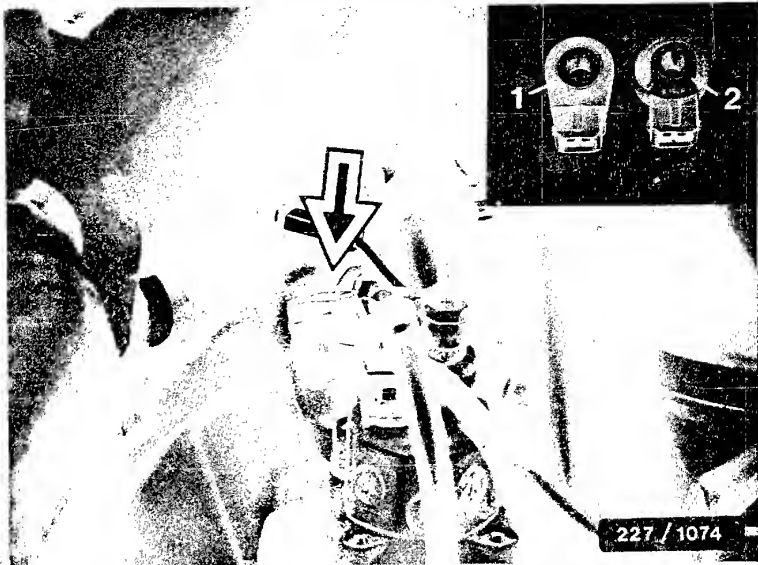
Installed only on vehicle with air conditioner and tropics radiator.

A8

Installation position of components

Volvo





Arrow = Knock sensor
 1 = Old version
 2 = New version

The knock sensor is located on the upper part of the engine block (driver's side).

Note:

See above for correct position of knock sensor (connection on side).

Attach mounting bolt of knock sensor w i t h o u t plain washer, spring lock washer, tooth lock washer, etc.

Tightening torque:

Old version	11 ... 15 Nm
New version	15 ... 25 Nm

Secure mounting bolt only with locking paint.

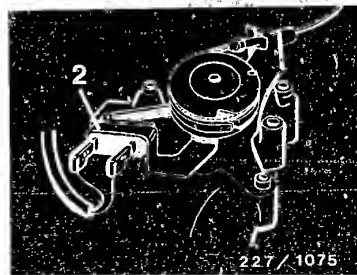
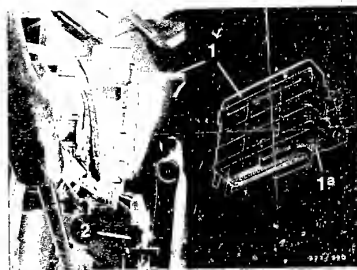
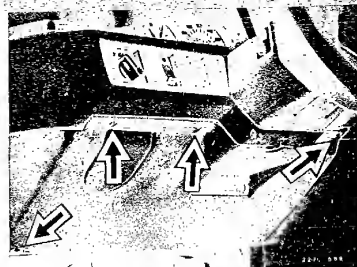


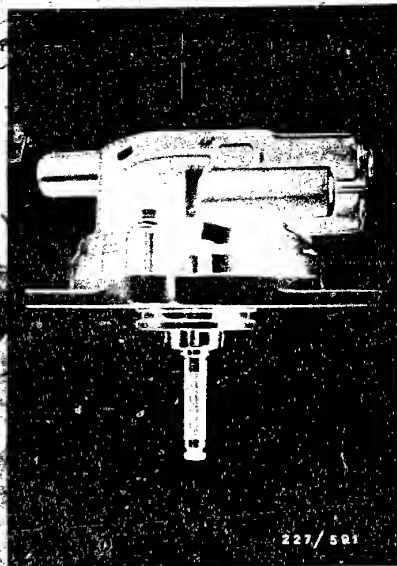
The EI-K control unit is located in the passenger compartment on the left-hand side next to the pedal block. See center illustration.

Old version of the microswitch (idle contact) is located beneath the accelerator pedal. See center illustration.

New version of the microswitch is located at the cable drum of the throttle-control mechanism. See lower illustration.

Key to figures: 1 - EI-K control unit
1a - Vacuum connection
2 - Microswitch





1 = Ignition distributor (with ignition pulse generator)

A12

Installation position of components

Volvo



5. Required test instruments and tools

Engine tester, e.g.	MOT 201	0 684 000 201
Pulse shaper (required for measuring the primary voltage with MOT 201, 202, 206 and 400)		1 684 463 154
Spark discharge tester, e.g. Ignition coil condenser tester	EFAW 106 A	0 681 100 001
or Single spark discharge tester	EF 1177 / 7	1 684 531 000
5 k Ω sleeve-type suppressor		0 356 500 001
Ohmmeter	ETE 014.00	0 684 101 400
or	Pontavi WH 2	commercially available
Voltmeter, e.g.	ETE 014.00	0 684 101 400
Evaluation unit (evaluation of self-diagnosis)		KDAW 9980
Test leads (for proper attachment of test equipment to connectors)		KDZS 0004
Test prods (for proper attachment of test equipment to connectors)		commercially available
Thermal conduction paste		5 942 860 003
Bolt locking paint, 30 g		5 703 245 003
Torque wrench Range: 5 ... 60 Nm		commercially available



Incorrect speed, dwell angle and firing point display

(continuation)

Auxiliary lead for user fabrication (e.g. to check anti-bollover function)

Parts required:

approx. 90 mm of 1.5 mm² cable

2 flat pin terminals

6 210 ...

8 784 480 011

Incorrect indication of speed, dwell angle and firing point by test equipment may occur in ignition systems with control unit 0 227 100 124 (TZ-1) incorporating current limitation.

See coordinates N 10 - N 14 for additional information.

7. Hazards in electronic ignition systems

Increased demands placed on ignition systems by modern engines, as well as the desire for reduced maintenance, caused electronic ignition systems to be introduced as standard equipment some time ago.

As a rule, the power supplied by nearly all electronic ignition systems exceeds that of conventional systems, and further increases are expected. Thus electronic ignition systems are within a power range where contact with live parts or terminals can be extremely hazardous (on both the primary and secondary sides).

We therefore recommend that any work or tests performed on the ignition system be in accordance with VDE Regulations (Association of German Electrical Engineers), particularly VDE 0104 dated July, 1967, as well as all pertinent national regulations.



The ignition must always be switched off when work is performed on the ignition system (switch off ignition and/or power supply).

This work includes:

- attaching engine testers (timing light, dwell-tach tester, ignition oscilloscope, etc.)
- replacing ignition system parts (spark plug, ignition coil, ignition distributor, ignition cable, etc.)

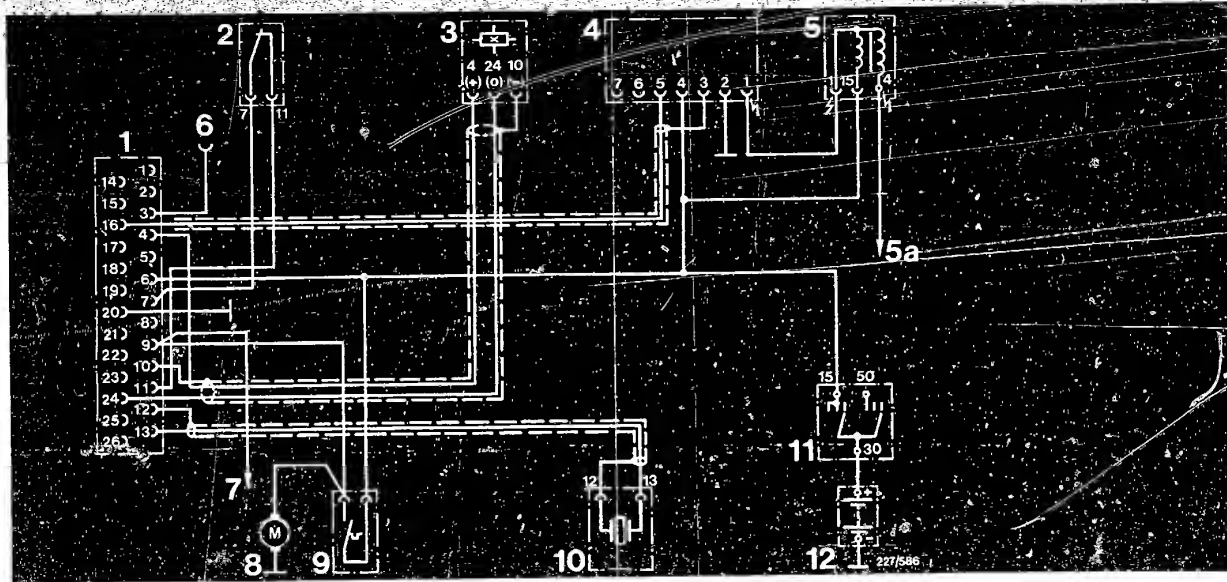
If, when checking the ignition system or when performing adjustments of the engine (e.g. mixture preparation), it becomes necessary to switch on the ignition (ignition/voltage source), the above-mentioned dangerous voltages occur over the entire system.

Hazards therefore exist not only within the individual subassemblies of the ignition system (e.g. ignition distributor, ignition coil, control unit, ignition harness), but also at the wiring harness (e.g. tachometer connector, diagnostic connector), plug connection cables and test equipment.

A15

Danger of accident
Volvo





Danger arrows: Warning: 400 V ... 25 kV

- 1 = EZ-K control unit
- 2 = Microswitch
- 3 = Ignition distributor
- 4 = Trigger box

- 5 = Ignition coil
- 5a = To ignition distributor
- 6 = Diagnostic connection
- 7 = To refrigerant compressor pressure monitor

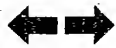
- 8 = Fan motor
 - 9 = Boiling-protection switch
 - 10 = Knock sensor
 - 11 = Ignition/starting switch
 - 12 = Battery
-) only vehicles with air conditioner and tropics radiator

3. Electrical terminal diagram

The dangerous locations are identified by danger arrows taking the example of the terminal diagram of an electronic ignition system.

A16

Danger of accident
Volvo



A17

Danger of accident
Volvo



8. Important vehicle information

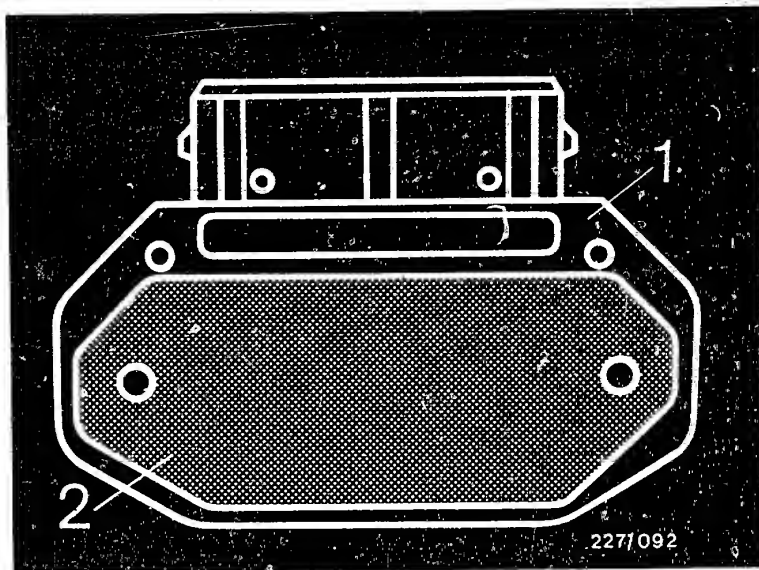
- Conduct resistance measurements only with ignition switched off or battery disconnected (tester defective)
- During compression testing remove control unit plug, or using an auxiliary cable securely connect ignition coil terminal 4 to ground (dangerously high voltage, insulation damage on ignition coil, ignition distributor, ignition harness).

Note:

Auxiliary cable must have at least 2 k Ω suppression, e.g. 5 k Ω sleeve-type suppressor 0 356 500 001.

- Do not replace specified ignition coil (see part No.) with a different type of ignition coil.
- Do not connect a suppression capacitor to ignition coil terminal 1.
- Do not connect ignition coil terminal 1 to ground as an anti-theft measure (when ignition is switched "on" ignition coil will be destroyed).
- Do not connect a positive battery terminal or test lamp to ignition coil terminal 1 (control unit will be destroyed).
- Do not remove the high voltage ignition cable between ignition coil terminal 4 and ignition distributor terminal 4 with the engine running.
- Flashover from ignition coil terminal 4 to ignition coil terminals 1 and 15 must be prevented. The magnetic pulse generator and control unit could be destroyed.





1 = Control unit

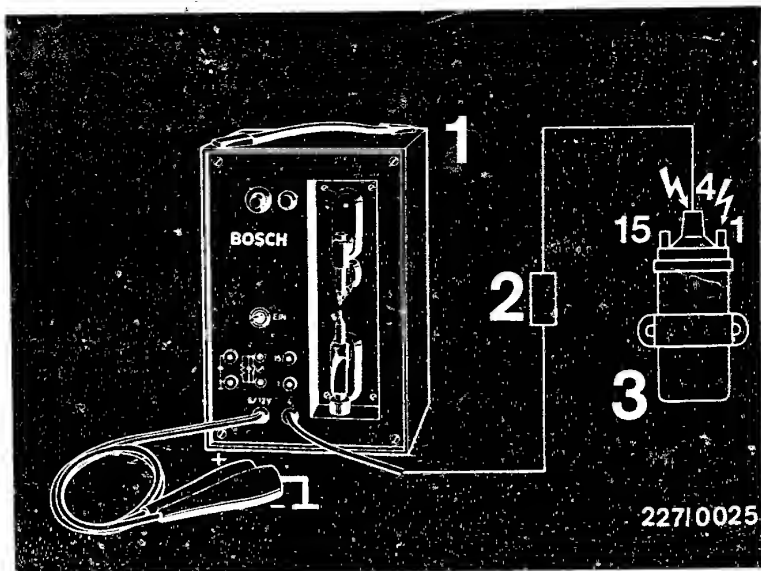
2 = Baseplate

- Coat baseplate with thermal conduction paste before mounting control unit.

Use only suitable object (screwdriver, match, etc.) to apply paste.

Keep thermal conduction paste off painted parts.





1 = Spark discharge tester
2 = 5 kΩ sleeve-type suppressor

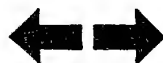
3 = Ignition coil

Danger arrows: 400 V ... 25 kV

- To prevent damage to the control unit when using a spark discharge tester, a suppression resistor of at least 2 kΩ must be connected between the spark discharge tester and ignition coil terminal 4 (e.g. 5 kΩ sleeve-type suppressor 0 356 500 001) to prevent damage to the control unit.

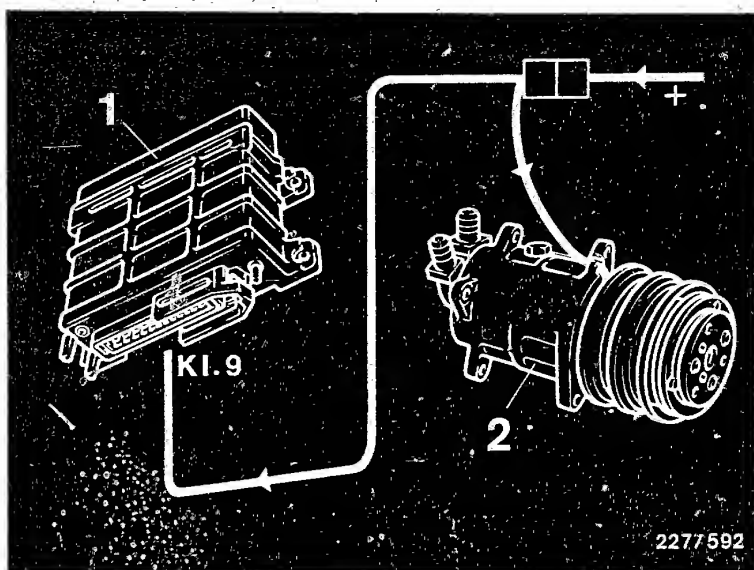
A20

Important vehicle information
Volvo



- To prevent damage to the control unit, a suppression resistance of at least 2 k Ω must be connected to the secondary side of the ignition system. The original distributor rotor must be installed with a 1 k Ω suppression resistor (also do not use a 5 k Ω distributor rotor for radio interference suppression).
- Do not attach any external voltage source such as an ohmmeter to the magnetic pulse generator (hall generator).
Use caution when switching meter ranges.
- Leads from ignition pulse generator to EZ-K control unit and from EZ-K control unit to trigger box must be shielded (malfunction of EZ-K control unit/trigger box).
- Flashover or punchthrough at ignition distributor cap (poor insulation) may destroy the magnetic pulse generator and the control unit.
- Do not disconnect battery terminals with engine running.
- Do not assist starting at more than 16 volts or with a fast charger.
- In the case of incorrect battery polarity, ignition pulse generator, trigger box and ignition coil as well as EZ-K control unit will be destroyed.
- Knock sensor cable must be shielded and routed separate from high voltage cables.
- Attach mounting bolt of knock sensor w i t h o u t plain washer, spring lock washer, tooth lock washer, etc. Secure mounting bolt only with locking paint.





- 1 = EZ-K control unit
2 = Refrigerant compressor

Idle compensation

Vehicles with air conditioner (AC)

After the switching-on of the refrigerant compressor, the EZ-K control unit ADVANCES the ignition by approx 13°.



9. Troubleshooting

9.1 Using the self-diagnosis system and the self-diagnosis test chart

This vehicle is equipped with an EZ-K control unit which has a self-diagnosis feature (knock control only).

Therefore every test conducted with the engine running must begin with the self-diagnosis system.

Coordinates B5/B6 describe how to activate the system.

The self-diagnosis test chart which begins at coordinates B7/B8 identifies trouble indicators (consisting of flashing code), causes of trouble and test procedures, and gives the coordinates for more specific troubleshooting.

If the self-diagnosis system indicates no trouble but the cause of the customer's complaint has not been eliminated, continue the troubleshooting procedure in accordance with the troubleshooting chart and the troubleshooting sequence beginning at coordinate B 9.

9.2 Using the troubleshooting chart

The troubleshooting chart beginning at coordinate B9 lists customer complaints (symptoms), causes of trouble, test procedures and reference coordinates.

Select the possible cause of the trouble which corresponds to the customer's complaint as indicated in the troubleshooting chart.

If the cause of the trouble is unclear, begin testing using the extensive, self-contained troubleshooting sequence beginning at coordinate B 15.

If the cause of the trouble can be clearly determined according to the troubleshooting chart, the problem can be pinpointed using the given coordinates without having to go through the entire troubleshooting sequence for each problem.

If no coordinates are given, proceed with troubleshooting using the "test steps" column.

9.3 Using the trouble-shooting program

The troubleshooting program beginning at coordinate B 15 is divided into 3 columns:

The left-hand column gives test steps and test values.

The center column gives instructions for repair.

The right-hand column contains the corresponding figures and wiring diagrams and indicates their locations.

If the questions given in the left-hand column can be answered "yes", go on to the next test directly below.

If a question is answered "no", move over to the center column and conduct the tests listed there.

9.4 Testing requirements

Battery fully charged, fuel system OK, engine in good working order (compression, valve clearance, etc.), ambient temperature or temperature of ignition system between 0 and 100°C (temperature has pronounced effect on measurements).

B3

Trouble-shooting/self-diagnosis
Volvo

**B4**

Trouble-shooting/self-diagnosis
Volvo



9.5 Activation of self-diagnosis

Test prerequisite: Engine running at in excess of 1000 min-1

General

The EI-K control unit features self-diagnosis with diagnosis connection in the engine compartment (see picture). Only 1 fault is ever indicated with this self-diagnosis. The first fault detected must be eliminated before further faults can be interrogated.

A total of 2 different faults (knock control only) can be recognized by way of the diagnosis connection in the form of a flashing code. The flashing pulses are recorded with the evaluation unit KDAW 9980 and assessed (counted) by the person performing the test.

Activation

Connect socket 1 of evaluation unit to battery term. 30 (+).
Connect socket 2 of evaluation unit to diagnosis connection (see picture).

Switch on ignition.

Lamp of evaluation unit must light up. If lamp does not light up, then perform test step on Coordinate B21/B22).

Then continue activation in accordance with Coordinate B5/B6.

Start engine; run it at in excess of 1000 min-1 and then at idle.

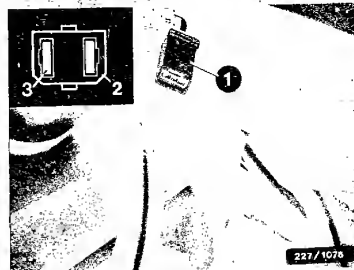
Lamp of evaluation unit flashes depending on fault.

The flashing code can be evaluated and the fault eliminated using the self-diagnosis test table (Coordinate B7/B8).

Note: There is a pause after every diagnosis run (lamp OFF).

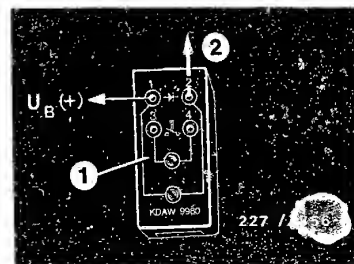
Diagnosis runs including pauses are repeated until ignition is switched off. This likewise clears the fault stored in the EI-K control unit.

Self-diagnosis activation with subsequent fault elimination must be repeated until no further flashing code is indicated (knock control is then O.K.).



- 1 = Diagnosis connection "old"
- 2 = Diagnosis connection "new"
- 3 = Diagnosis terminal post

- 1 = Evaluation unit KDAW 9980
- 2 = to diagnosis connection



B5

Trouble-shooting/self-diagnosis
Volvo



B6

Trouble-shooting/self-diagnosis
Volvo



Self-diagnosis checking table

Fault indication Flashing code	Cause of fault	Test instructions	Coordinates
No flashing code	Knock control O.K.	-----	-----
1 Not used	-----	-----	-----
2 Not used	-----	-----	-----
3 Not used	-----	-----	-----
4	Knock control defective	Check knock sensor (mounting of knock sensor, open circuit/short circuit), or EZ-K control unit defective.	C 11
5	EZ-K control unit defective	Replace EZ-K control unit	-----

B7

Trouble-shooting/self-diagnosis
Volvo



B8

Trouble-shooting/self-diagnosis
Volvo



9.6 Troubleshooting chart

Customer complaint (symptom)

1. Starter engages, engine does not start
 2. Rough idle
 3. Engine gets no gas (flow problem)
 4. Poor engine performance
 5. Engine misfires
 6. Fuel consumption too high
 7. Engine pings or knocks
 8. Faulty ignition
 9. Engine runs too hot

											Cause of trouble	Test steps	Coordinates
•	•	•	•	•	•	•	•	•	•	•	Unclear	Perform thorough troubleshooting	B 15
•	•	•	•	•	•					•	Spark plugs defective	Evaluate ignition oscilloscope trace or remove and visually check spark plug	----
		•	•	•	•						Suppression resistors defective	Evaluate oscilloscope trace or measure resistance	----
•	•	•	•	•							Shunt on secondary side	Check ignition coil, ignition distributor, ignition harness and spark plug by means of oscilloscope trace or visual check	----
•	•	•	•	•							Open circuit on secondary side	Check ignition coil, ignition distributor, ignition harness and spark plug by means of oscilloscope trace or check continuity using ohmmeter	----
•											Open circuit on primary side	---	D 1
•	•	•	•	•							Ignition coil defective	---	B 17



Trouble-shooting chart (continued)

Customer complaint (fault symptom)

1. Starting motor operates, engine fails to start

2. Rough idle

3. Poor throttle take-up (flat spot on acceleration)

4. Insufficient engine power

5. Misfiring

6. Fuel consumption too high

7. Engine pinging/knocking

8. Backfiring

9. Engine overheating

Cause of fault

Test instructions

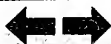
Coordinates

●	●						●	Firing sequence incorrect	Firing sequence 1 - 3 - 4 - 2	-----
●								Contact resistance at trigger box/ EZ-K control unit not O.K.	-----	B 19
			●		●			Microswitch idle contact defective	-----	B 23
		●	●	●	●	●	●	Basic ignition timing incorrect	To prevent incorrect setting, see coordinates for testing.	B 23...C 1
							●	Control lead/boiling-Protection switch defective	-----	C 5
							●	Fan motor defective	-----	C 7
							●	Boiling-protection function incorrect	-----	C 9

B11

Trouble-shooting/trouble-shooting chart

Volvo



B12

Trouble-shooting/trouble-shooting chart

Volvo



Trouble-shooting chart (continued)

Customer complaint (fault symptom)

1. Starting motor operates, engine fails to start

2. Rough idle

3. Poor throttle take-up (flat spot on acceleration)

4. Insufficient engine power

5. Misfiring

6. Fuel consumption too high

7. Engine pinging/knocking

8. Backfiring

9. Engine overheating

Cause of fault

Test instructions

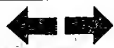
Coordinates

			●		●			Knock sensor or EZ-K control unit defective	-----	C 11
		●	●		●	●		EZ-K control unit vacuum sensor defective	-----	C 17
●								Trigger box power supply defective	-----	D 1
●								EZ-K control unit power supply defective	-----	D 3
●								Ignition pulse generator defective	-----	D 7
●								EZ-K control unit defective	-----	D 11
			●		●			Abnormal engine noises	Engine mechanically defective (bearing damage, valve spring broken etc)	----
			●		●	●		Fuel consumption not O.K.	Fuel with insufficient octane number	----

B13

Trouble-shooting/Trouble-shooting chart

Volvo



B14

Trouble-shooting/Trouble-shooting cart

Volvo



9.7 Trouble-shooting program

Check primary signal.

If oscilloscope or tachometer tester not available, check for ignition spark on spark discharge tester.

Primary signal with oscilloscope

Connect oscilloscope to ignition coil as per operating instructions. Start engine. Oscilloscope must indicate primary voltage (magnitude not important).

Primary signal with tachometer tester

Connect tachometer tester to ignition coil as per operating instructions. Start engine. Tachometer tester must register a value (magnitude not important).

Ignition spark with spark discharge tester

Remove high tension ignition cable at terminal 4 of ignition coil.
Connect spark discharge tester with sleeve-type suppressor (5 k Ω) to ignition coil.
Set spark gap to 5 mm.
Start engine.
Sparks must appear across spark gap.

Are primary signal and/or ignition sparks in spark gap present?

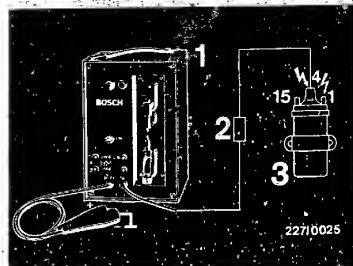
yes

Continued on B 17/B 18

no

If no primary signal or ignition spark is present, continue test at coordinate D 1.

Test beginning at B 17 not necessary.



- 1 = Spark discharge tester
- 2 = 5 k Ω sleeve-type suppressor
- 3 = Ignition coil

Danger arrows: Warning: 400 V...25 kV

B 15

Trouble-shooting program

Volvo

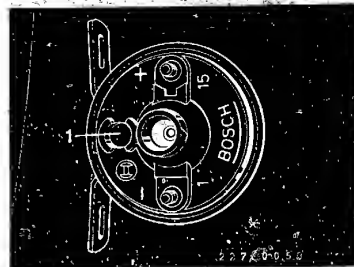
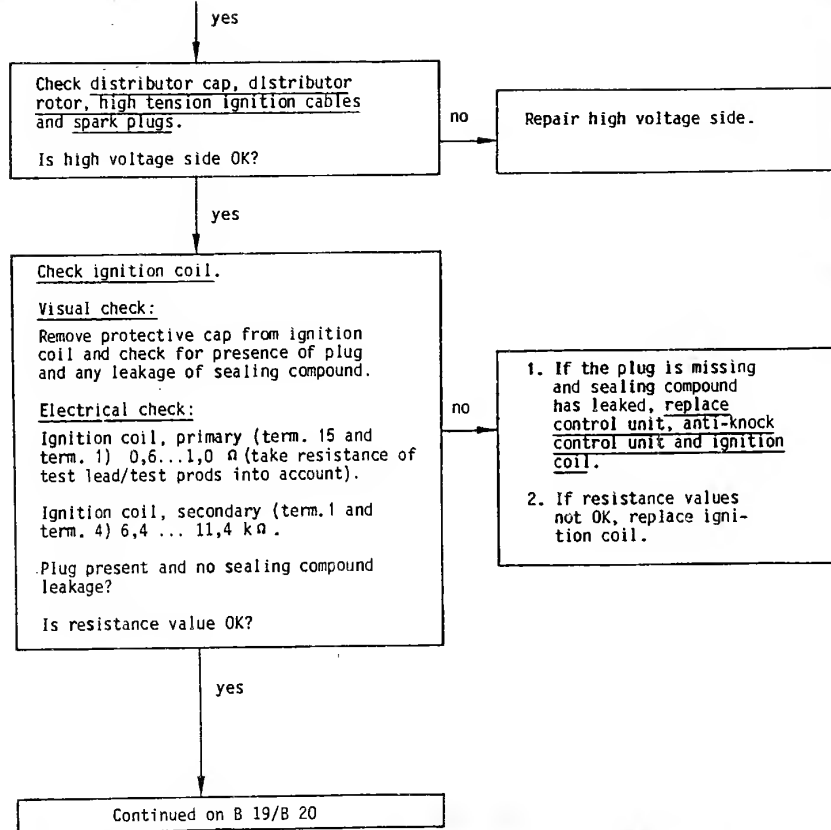


B 16

Trouble-shooting program

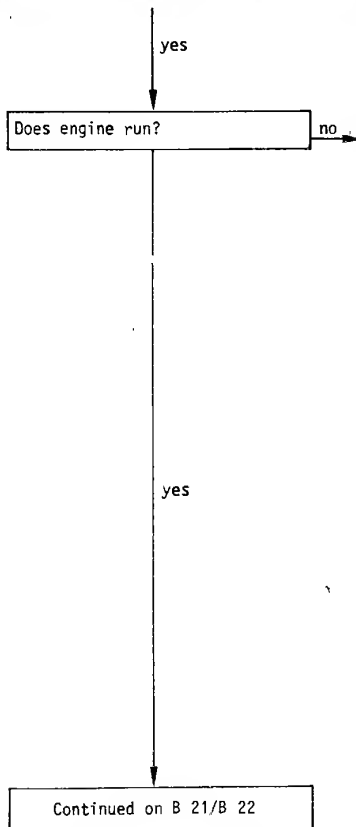
Volvo





1 = Plug





Step 1

Disconnect positive and negative battery cables. Disconnect trigger-box plug after pressing wire retainer. Switch on ignition.

Check leads from positive battery terminal to control unit connector terminal 4 and from negative battery terminal to control unit connector terminal 2 for contact resistance. Max. total contact resistance 0.3Ω (take resistance of test lead/test prod into account). Eliminate contact resistance.

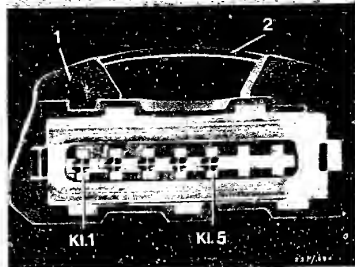
Check leads from positive battery terminal to ignition coil terminal 15 and the lead from ignition coil terminal 1 to control unit connector terminal 1 for contact resistance. Max. total contact resistance 0.3Ω (take resistance of test lead/test prod into account). Eliminate contact resistance.

Step 2

Reconnect battery. Attach dwell angle tester to ignition coil as per operating instructions.

Start engine. Dwell angle tester must indicate 27 ... 33% (only during starting). If dwell angle not correct, replace EZ-K control unit.

If steps 1 and 2 were OK, replace control unit.



1 = Trigger-box plug
2 = Wire retainer



yes

Check diagnosis connector

1. Connect evaluation unit KDAW 9980 to battery positive and diagnosis connection (see top picture). Switch on ignition (do not start engine). Fault lamp (evaluation unit) must light up.

2. Start engine and briefly run up to $> 1000 \text{ min}^{-1}$. Then run at idle. Fault lamp is OFF or may indicate flashing pulses.

Is voltage under 1 and 2 above OK?

no

1. If fault lamp did not light up in item 1, disconnect EI-K control-unit plug (bottom picture) and examine lead from EI-K control-unit plug term. 3 to diagnosis connection for open-circuit.

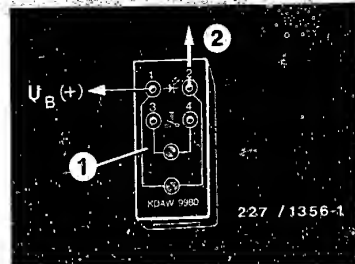
Eliminate open circuit.

If there was no open circuit, replace EI-K control unit.

2. If fault lamp lights up continuously in item 2, check lead from EI-K control-unit plug term. 3 to diagnosis connection for short-circuit to ground.

Eliminate short circuit to ground.

If there was no short circuit to ground, replace EI-K control unit.

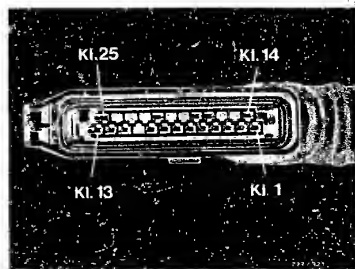


1 = Evaluation unit KDAW 9980
2 = to diagnosis connection

yes

Continued on B23/B24

EI-K control unit



B21

Trouble-shooting program

Volvo



B22

Trouble-shooting program

Volvo



yes

Check microswitch idle contact

Switch off ignition. Disconnect EZ-K control-unit plug. See picture.

Connect ohmmeter to disconnected EZ-K control-unit plug term. 7 and term. 11.

Accelerator pedal is at idle position.

Ohmmeter must indicate approx 0Ω (continuity).

Actuate accelerator pedal so that throttle valve opens 1...2" (idle contact open).

Ohmmeter must now indicate $\infty \Omega$ (open circuit).

Resistance values O.K.?

no

1. Disconnect both microswitch plugs. See bottom picture (new version not illustrated).

Connect ohmmeter, one after the other, to:

Microswitch plug

EZ-K control-unit plug

Term. 7
(orange lead)

and term. 7

Ohmmeter must indicate approx. 0Ω (continuity).
If $\infty \Omega$ indicated, eliminate open circuit.

Microswitch plug

EZ-K control-unit plug

Term. 11
(black lead)

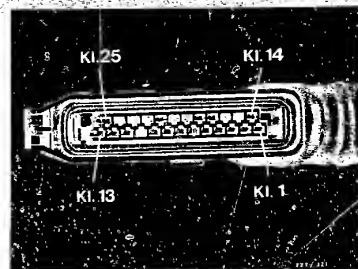
and term. 11

Ohmmeter must indicate approx. 0Ω (continuity).
If $\infty \Omega$ indicated, eliminate open circuit.

2. If there was no open circuit, replace micro-switch.

yes

Continued on C 1/C 2



EZ-K control-unit plug

- 1 = Microswitch
2 = Microswitch (removed)



B23

Trouble-shooting program

Volvo



B24

Trouble-shooting program

Volvo



yes

Check basic ignition timing.

Only on vehicle with air conditioner and tropics radiator, disconnect plug from boiling-protection switch. See arrow, top picture.

Engine at normal operating temperature ($> +60^{\circ}\text{C}$ coolant temperature).
Start engine and operate briefly at speed $> 1000 \text{ min}^{-1}$ and then at $750 \dots 1000 \text{ min}^{-1}$.

Caution:

Microswitch (idle contact) must be closed. Switch off air conditioner. Vehicle with automatic transmission, selector lever in position "P/N". (In case of clearly incorrect reading of engine speed on testers, connect in series resistor or convert motortester).

Aim timing light at ignition mark.

Basic ignition timing must be $12 \pm 1^{\circ}$ BTDC.

See center picture.

Basic ignition timing O.K.?

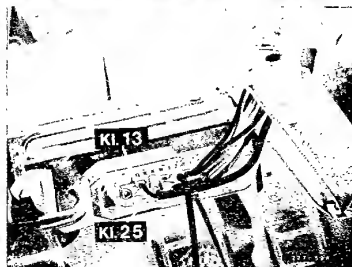
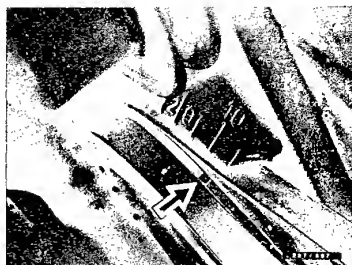
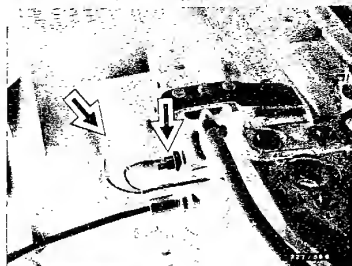
yes

Continued on C 5/C 6

no

1. Switch off ignition. Remove EZ-K control unit and disconnect plug. Push back handle cover of EZ-K control-unit plug after unscrewing fastening screws and removing sealing rubber. Connect EZ-K control-unit plug. See bottom picture. Connect voltmeter, positive to EZ-K control-unit plug term. 9 and negative to term. 20. Run engine at idle. Voltmeter must indicate approx 0 V. If battery voltage indicated, eliminate positive connection.

Continued on C 3/C 4



C1

Trouble-shooting program

Volvo



C2

Trouble-shooting program

Volvo



Continued

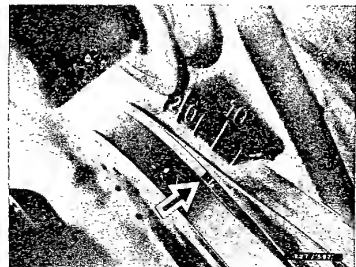
2. If there was no positive connection, loosen ignition distributor mounting (arrow, top picture) and turn ignition distributor until $12 \pm 1^\circ$ BTDC is obtained.



yes

Continued on C 5/C 6

Ignition timing mark



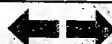
C3

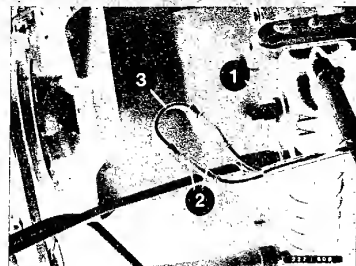
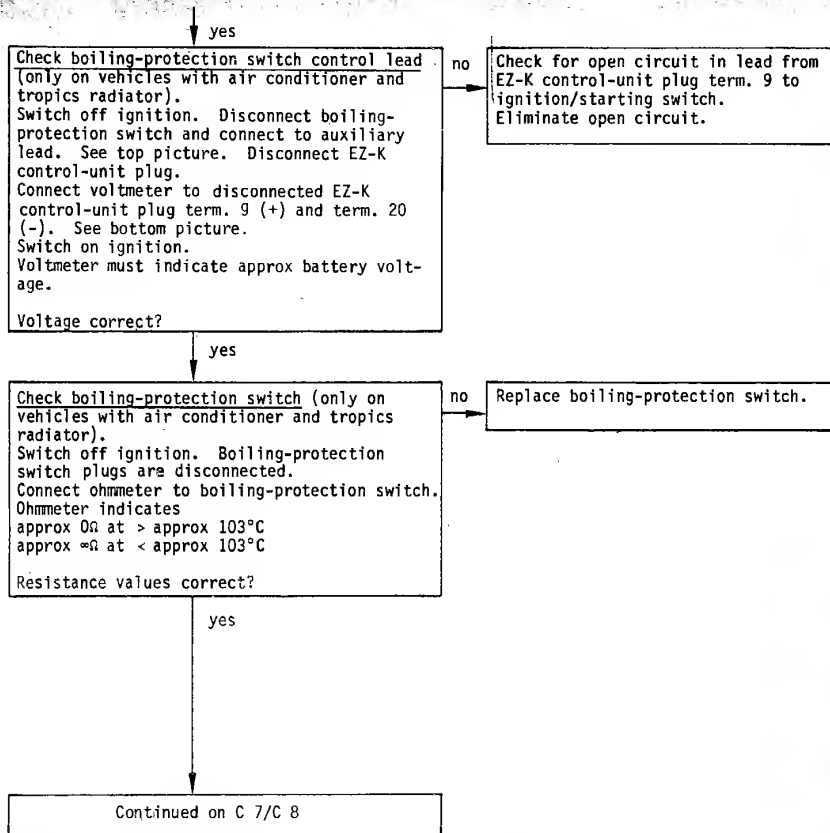
Trouble-shooting program
Volvo



C4

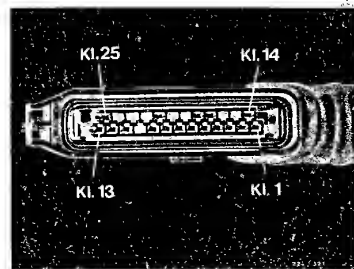
Trouble-shooting program
Volvo





1 = Boiling-protection switch
2 = Boiling-protection switch plug
3 = Auxiliary lead

EZ-K control-unit plug



C5

Trouble-shooting program

Volvo



C6

Trouble-shooting program

Volvo



yes

Check fan motor
(only on vehicles with air conditioner and
tropics radiator).

Remove both anti-boilover switch
connectors and bridge them with an
auxiliary lead. See top photograph.

Switch on ignition.

Fan motor must run.

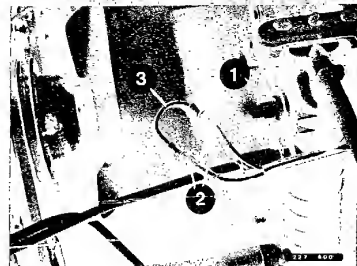
Does fan motor run?

no

Check lead from anti-boilover
switch connector to fan motor
and motor ground connection
for continuity.

Eliminate discontinuity.

If no discontinuity is found,
replace fan motor.

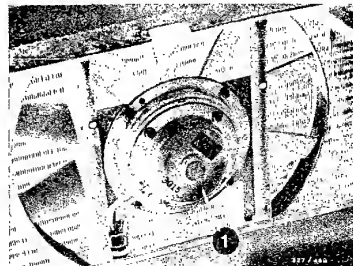


- 1 = Anti-boilover switch
- 2 = Anti-boilover switch
connector
- 3 = Auxiliary lead

yes

Continued on C 9/C 10

Fan motor



C7

Trouble-shooting program
Volvo



C8

Trouble-shooting program
Volvo



yes

Check boiling-protection function (only on vehicles with air conditioner and tropics radiator). Disconnect boiling-protection switch plug and connect to auxiliary lead. See top picture.

no

Replace EZ-K control unit.

Start engine and run briefly at speed $> 1000 \text{ min}^{-1}$ and then at idle. Microswitch idle contact closed. (In case of clearly incorrect reading of engine speed on testers, connect in series resistor or convert motor-tester).

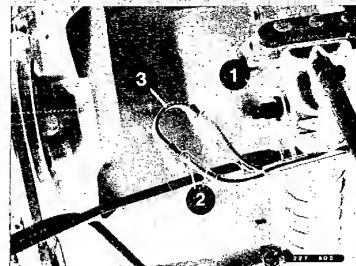
Aim timing light at ignition mark.

Spark advance must be $23 \dots 27^\circ \text{ BTDC}$.

Spark advance correct?

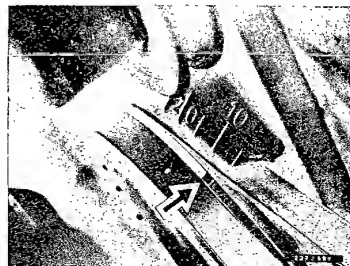
yes

Continued on C 11/C 12



- 1 = Boiling-protection switch
- 2 = Boiling-protection switch plug
- 3 = Auxiliary lead

Ignition timing mark



C9

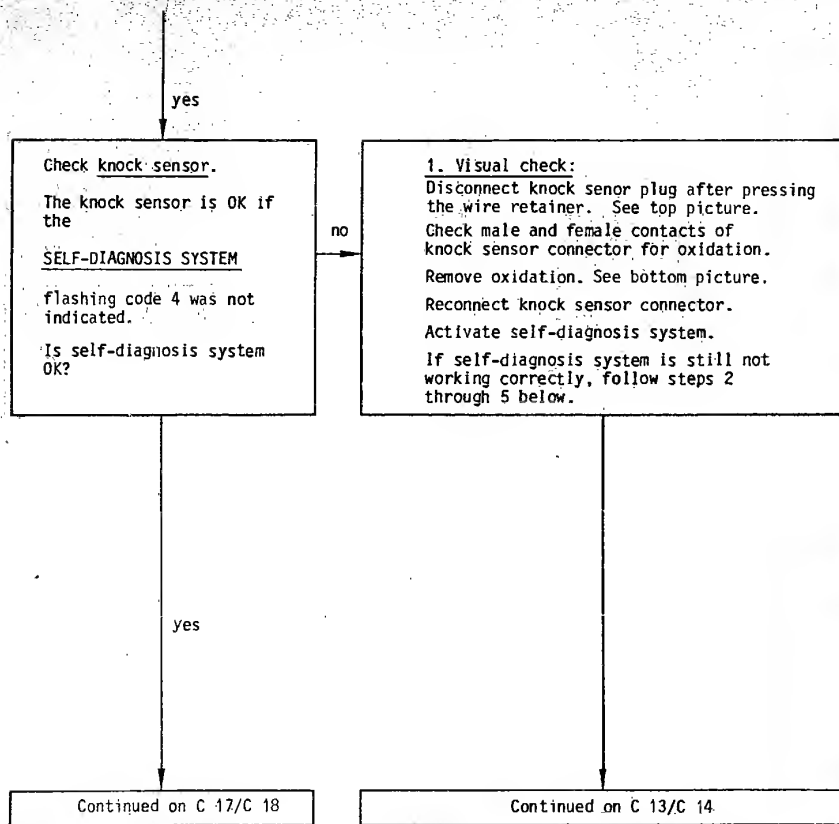
Trouble-shooting program
Volvo



C10

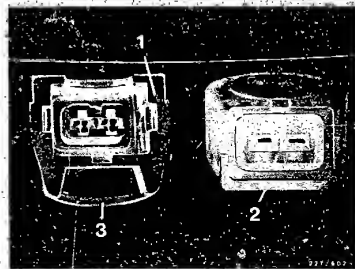
Trouble-shooting program
Volvo





Arrow = Knock sensor
 1 = Old version
 2 = New version

1 = Knock sensor plug
 2 = Knock sensor socket
 3 = Wire retainer



C11

Trouble-shooting program

Volvo



C12

Trouble-shooting program

Volvo



Continued

Switch off ignition.
Disconnect knock sensor plug and EZ-K control-unit plug.

2. Connect ohmmeter to:
Knock sensor plug EZ-K control-unit plug

Term. 12 and term. 12
Term. 13 and term. 13

Ohmmeter must indicate approx 0 Ω (continuity).
Eliminate open circuit.

3. Connect ohmmeter to:
Knock sensor plug EZ-K control-unit plug

Term. 13 and term. 20

Ohmmeter must indicate $\infty \Omega$. If ohmmeter indicates approx 0 Ω (continuity), eliminate short circuit to ground between knock sensor lead term. 13 and term. 20.

4. Conduct only on the "old" knock-sensor version.
Connect knock-sensor plug and connect ohmmeter to:

EZ-K control-unit plug EZ-K control-unit plug
Term. 12 and term. 13

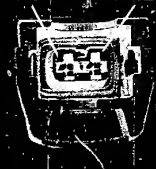
Ohmmeter must indicate 270...330 k Ω
If resistance value not correct, replace knock sensor.

yes

Continued on C 17/C 18

Continued on C 15/C 16

Kl.13 Kl.12

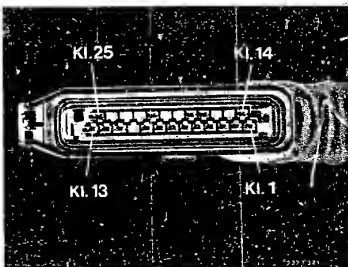


Knock sensor plug

EZ-K control-unit plug

Kl.25 Kl.14

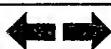
Kl.13 Kl.1



C13

Trouble-shooting program

Volvo



C14

Trouble-shooting program

Volvo



Continued

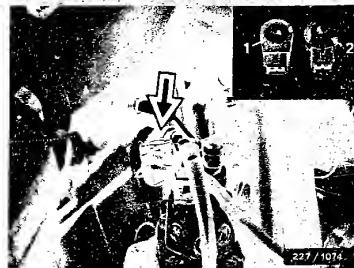
5. Tightening torque:

Old version 11 ... 15 Nm

New version 15 ... 25 Nm

If points 1 ... 5 O.K.,
replace knock sensor.
Self-diagnosis reactivates.

If flashing code 4 is still indicated,
re-install previously removed knock sensor
and renew EI-K control unit.



Arrow = Knock sensor

1 = Old version

2 = New version

yes

Continued on C 17/C 18

C15

Trouble-shooting program

Volvo



C16

Trouble-shooting program

Volvo



yes

Check operation of vacuum sensor.

Disconnect vacuum hose (1) from intake manifold (2).

Connect vacuum pump (3) to disconnected vacuum hose. See top picture.

Remove steering column cover. Disconnect 1 connector from microswitch. See arrow, center picture (new version not illustrated).

Operate engine at approx 3000 min⁻¹. Adjust manual adjustment (delay) on ignition timing light until approx 10° BTDC is indicated. See bottom picture.

Build up approx 700 mbar with vacuum pump.

Ignition timing must move in "ADVANCE" direction.

Ignition timing **ADVANCED?**

yes

Connect microswitch plug (to both outer connections - arrow, center picture).

Connect vacuum hose (1).

yes

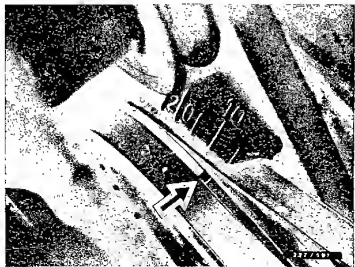
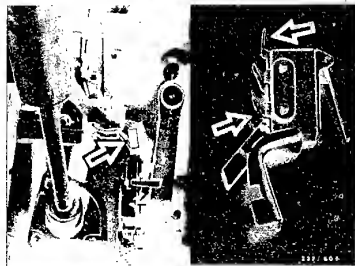
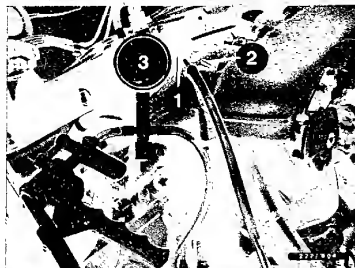
Continued on C 19/C 20

no

Check vacuum hose (1) between intake manifold (2) and EZ-K control unit for leaks.

Eliminate leaks.

If there was no leak, replace EZ-K control unit.



C17

Trouble-shooting program

Volvo

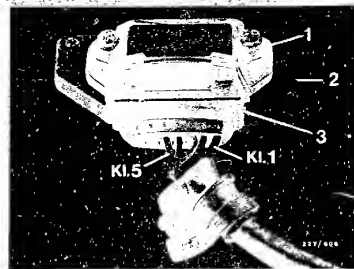
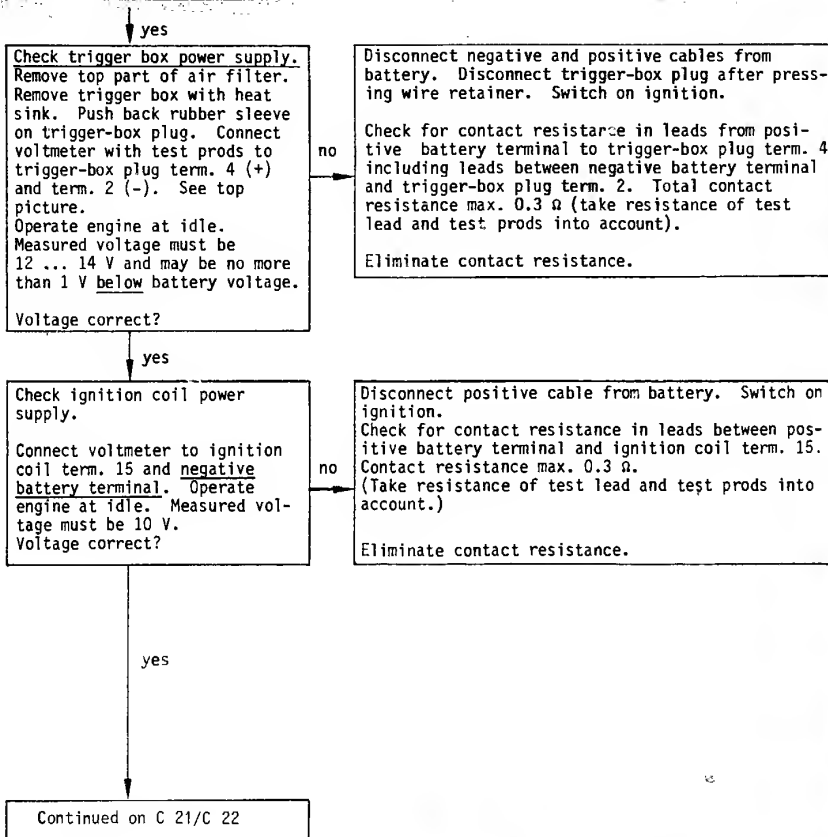


C18

Trouble-shooting program

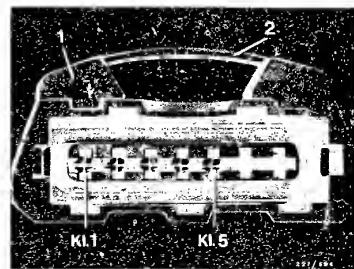
Volvo





- 1 = Trigger box
- 2 = Heat sink
- 3 = Trigger-box plug

- 1 = Trigger-box plug
- 2 = Wire retainer



yes

Check primary voltage.

(if MOT series oscilloscope available)

Connect oscilloscope (e.g. MOT 201) together with pulse shaper 1 684 463 154 to ignition coil in accordance with operating instructions.

Note: Incorrect measured value without pulse shaper.

Run engine at idle.

The primary voltage must be 295 ... 365 V (see illustration).

Is voltage value OK?

no

Replace control unit.

yes

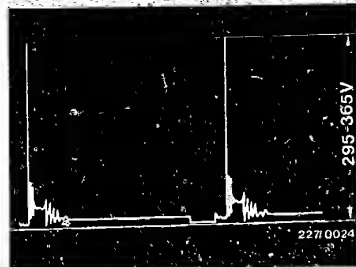
Ignition system OK

Test completed.

Test beginning at coordinate D 1 not necessary.

Note:

If customer complaint still exists, fault may be in fuel system or engine may have mechanical problem.



C21

Trouble-shooting program

Volvo



C22

Trouble-shooting program

Volvo



No primary signal or no ignition
spark

(continued from B 15/B 16)

yes

Check voltage from control unit.
Switch off ignition.
pressing wire retainer.
Unplug control unit connector.
Connect positive lead of voltmeter to
terminal 4 and negative lead to
terminal 2 of control unit connector.
Switch on ignition.
Voltmeter must indicate battery
voltage. Is voltage value OK?

no

Check leads and connections
between ignition/starter
switch and control unit con-
nector terminal 4 and ground
lead terminal 2 for discon-
tinuity.
Eliminate discontinuity.

yes

Check primary circuit.

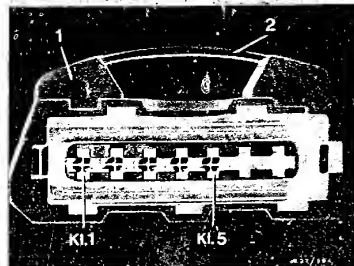
Connect positive lead of voltmeter to
terminal 1 and negative lead to
terminal 2 of unplugged control unit
connector.
Switch on ignition.
Voltmeter must indicate battery
voltage.
Is voltage value OK?

no

Check lead from ignition/starter
switch to ignition coil term-
inal 15, the primary winding of
the ignition coil, and the lead
from ignition coil terminal 1 to
control unit connector terminal
1 and ground lead terminal 2 for
continuity.
Eliminate discontinuity.

yes

Continued on D 3/D 4



1 = Trigger-box plug
2 = Wire retainer

D1

Trouble-shooting program

Volvo



D2

Trouble-shooting program

Volvo



yes

Check EZ-K control unit power supply.

Switch off ignition.

Disconnect EZ-K control-unit plug.

Connect voltmeter to EZ-K control-unit plug
term. 6 (+) and term. 20 (-).

Switch on ignition.

Voltmeter must indicate battery voltage.

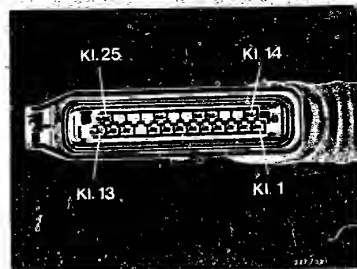
Is voltage OK?

no

Check for open circuit in lead from
ignition/starting switch to EZ-K
control-unit plug term. 6 including
ground lead term. 20.
Eliminate discontinuity.

yes

Continued on D 5/D 6



EZ-K control-unit plug

D3

Trouble-shooting program

Volvo



D4

Trouble-shooting program

Volvo



yes

Check male and female halves of
ignition distributor connector.

Disconnect ignition-distributor plug
after pressing wire retainer (arrow).

Unplug ignition distributor connector.

Visual check:

Check male and female contacts of
ignition distributor connector for
oxidation.

Remove oxidation.

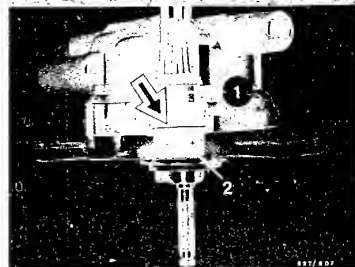
Reconnect ignition distributor
connector.

Start engine.

If no primary signal or ignition
spark, continue test.

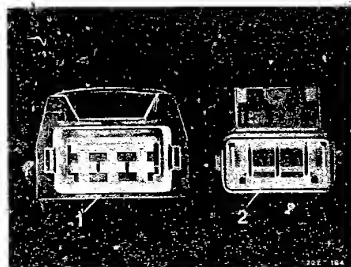
yes

Continued on D 7/D 8



1 = Male ignition distributor
connector

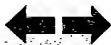
2 = Female ignition distributor
connector



D5

Trouble-shooting program

Volvo



D6

Trouble-shooting program

Volvo



yes

Check ignition pulse generator. Switch off ignition.
Remove EZ-K control unit and disconnect plug. Push back handle cover of EZ-K control-unit plug after unscrewing fastening screws and removing sealing rubber. See top picture. Connect EZ-K control-unit plug. Connect oscilloscope in accordance with operating instructions with program switch in "special" position.
For example, MOT 201:
Red clamp to EZ-K control-unit plug term. 24 (measured signal). Black clamp to vehicle ground.
Start engine.
Oscilloscope must indicate rectangular pulse. See bottom diagram.

Rectangular pulse present?

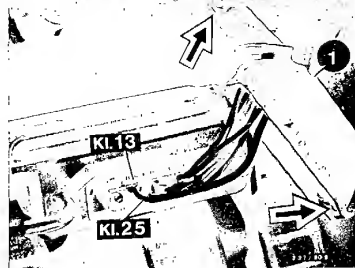
yes

Continued on 0 11/D 12

no

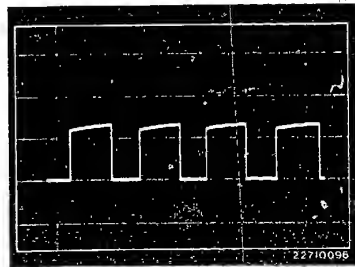
1. Connect voltmeter to EZ-K control-unit plug term. 4 (+) and term. 10 (-).
Switch on ignition.
Voltmeter must indicate > 10 V.
If < 10 V indicated, replace EZ-K control unit.

Continued on 0 9/0 10



1 = Handle cover
Arrow = Fastening screws

Rectangular pulse



D7

Trouble-shooting program

Volvo



D8

Trouble-shooting program

Volvo



Continued

2. Switch off ignition.
Disconnect ignition-distributor plug and EZ-K control-unit plug.
Connect ohmmeter, one after the other, to:

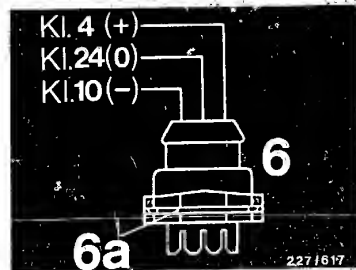
<u>Ignition-distributor</u> <u>plug</u>		<u>EZ-K control-unit</u> <u>plug</u>
Term. 4	and	term. 4
Term. 10	and	term. 10
Term. 24	and	term. 24

In each case, ohmmeter must indicate approx 0Ω (continuity).
Eliminate open circuit.

If there was no open circuit, replace ignition pulse generator/ignition distributor.

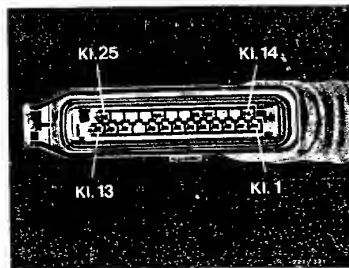
yes

Continued on D 11/D 12



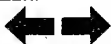
6 = Ignition-distributor plug
6a = Wire retainer

EZ-K control-unit plug



D9

Trouble-shooting program
Volvo



D10

Trouble-shooting program
Volvo



yes

Check EZ-K control unit.

EZ-K control-unit plug and ignition-distributor plug connected.

Connect oscilloscope set to "special" range as per operating instructions.

For example MOT 201:
Red clamp to disconnected trigger-box plug term. 5 (measured signal).

Connect black lead to ground.

Start engine.

Oscilloscope must display square wave.
See illustration.

Is square wave displayed?

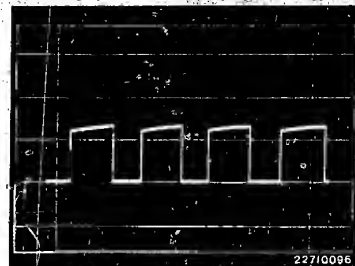
no

Disconnect trigger-box plug and EZ-K control-unit plug.

yes

Continued on D 15/D 16

Continued on D 13/D 14



Square wave

D 11

Trouble-shooting program
Volvo



D 12

Trouble-shooting program
Volvo



Continued

Connect ohmmeter to the following one
after the other:

Control unit
connector

EZ-K control-unit plug

term. 5

term. 16

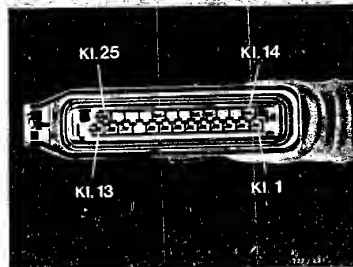
Ohmmeter must indicate approx. 0 Ω
(continuity) in each case.

Eliminate discontinuity.

If there was no open circuit, replace EZ-K
unit.

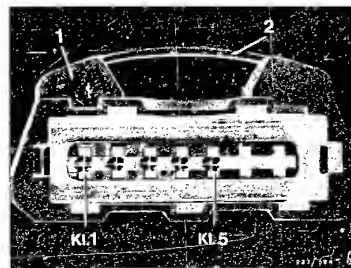
yes

Continued on D 15/D 16



EZ-K control-unit plug

1 = Control unit connector
2 = Wire retainer



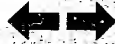
D13

Trouble-shooting program
Volvo



D14

Trouble-shooting program
Volvo



↓ yes

Check ignition coil.

Visual examination:

Check whether plug (see picture) is present and whether sealing compound has escaped.

Electrical test:

Ignition coil, primary
(Term. 15 and term. 1) $0.6 \dots 1.0 \Omega$ (take resistance of test lead and test prods into account).

Ignition coil, secondary
(Term. 1 and 4) $6.4 \dots 11.1 \text{ k}\Omega$.

Plug present and/or no sealing compound escaped?

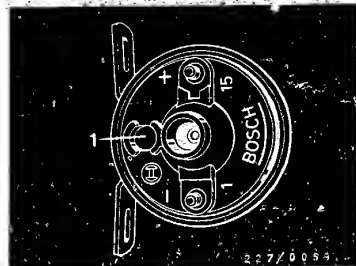
Resistance value correct?

no

1. If plug not present and/or sealing compound escaped, replace trigger box, EZ-K control unit and ignition coil.

2. If resistance values are not OK, replace ignition coil.

1 = Plug



↓ yes

Replace control unit.

Test completed.

Tests at B 17 not necessary.

Note:

If customer complaint still exists, problem may be in fuel system or engine may have mechanical problem.

D15

Trouble-shooting program

Volvo



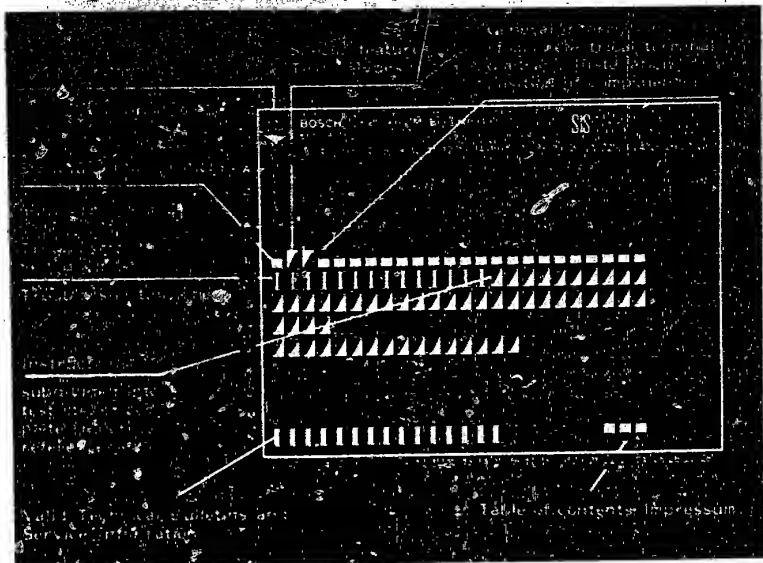
D16

Trouble-shooting program

Volvo



Structure of microfiche

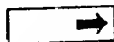


1. Read from left to right
2. Title of microfiche (appears on each coordinate)

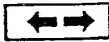
E16	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section



Beginning



Mid-section



End



One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

C6

E1

Trouble-shooting program



1. Special features

Vehicle, VOLVO 740, 760, 1984 → Engine B230F, B230FT
USA, Canada, Japan with:

Trigger box	0 227 100 124 (with current limitation)
Ignition coil	0 221 118 351
EZ-K control unit	0 261 201 011 Engine B230 F
EZ-K control unit	0 261 201 012 Engine B230 FT

2. Test specifications

Ignition coil, primary	0.6...1.0Ω	F17
Ignition coil, secondary	6.4...11.1 kΩ	
Dwell angle at cranking speed	27...33%	F19
Basic ignition timing at	12+ 1° BTDC 750...1000 min ⁻¹	G1 ↓ G8
Boiling-protection switch	> approx 103° C approx 0 Ω < approx 103° C approx ∞ Ω	G9
Spark advance at idle (Boiling-protection switch jumped)	23...27° BTDC	G13
Knock sensor "OLD"	270 ... 330 kΩ	G15 ↓ G20
Knock sensor "NEW"	---	
Tightening torque:		
Knock sensor "OLD"	11 ... 15 Nm	
Knock sensor "NEW"	15 ... 25 Nm	



Test values (cont'd.)

Voltage to
control unit

12 ... 14 V

H1

Voltage to
ignition coil

≥ 10 V

Primary voltage at
idle

295 ... 365 V

H3

Voltage to
magnetic pulse
generator with
ignition on

≥ 10 V

J7

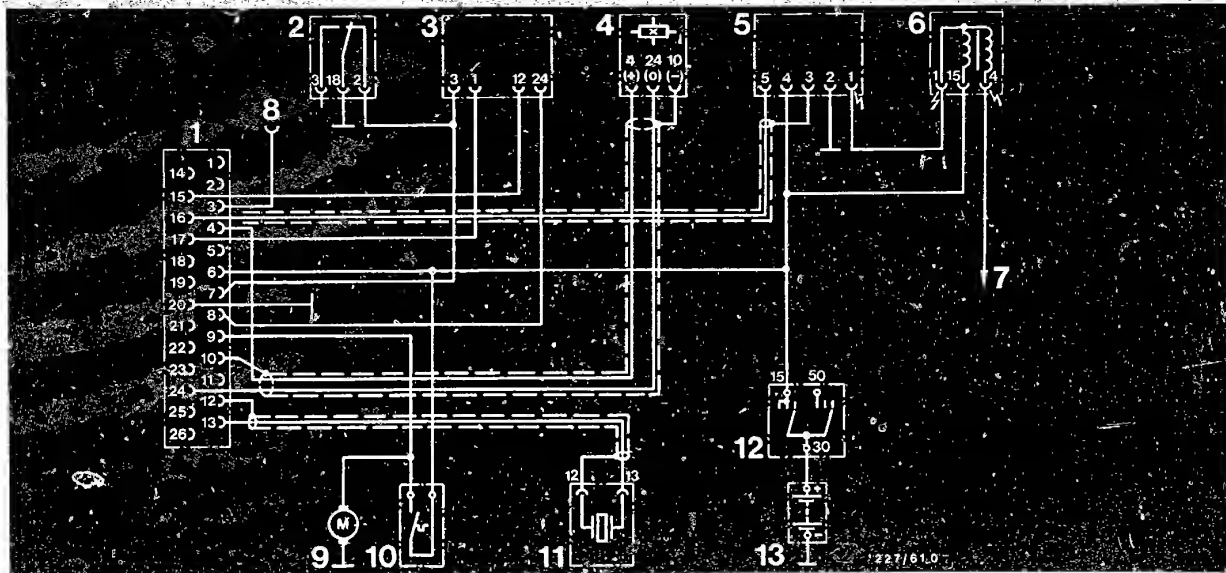
See Jetronic SIS microcard for settings for idle
speed, exhaust gas.

E3

Test specifications

Volvo





Danger arrows: Warning: 400 V ... 25 kV

- 1 = EZ-K Control unit
- 2 = Throttle-valve switch
- 3 = LH-Jetronic control unit
- 4 = Ignition pulse generator

- 5 = Trigger box
- 6 = Ignition coil
- 7 = To ignition distributor
- 8 = Diagnostic connection

- 9 = Fan motor
- 10 = Boiling-protection switch) only for vehicles with air conditioner and tropics radiator
- 11 = Knock sensor
- 12 = Ignition/starting switch
- 13 = Battery

3. Electrical terminal diagram

E4

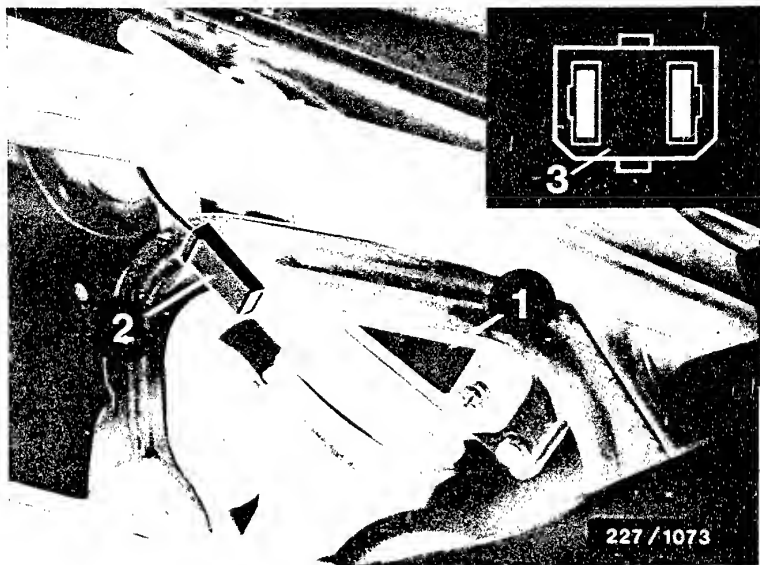
Electrical terminal diagram
Volvo



E5

Electrical terminal diagram
Volvo





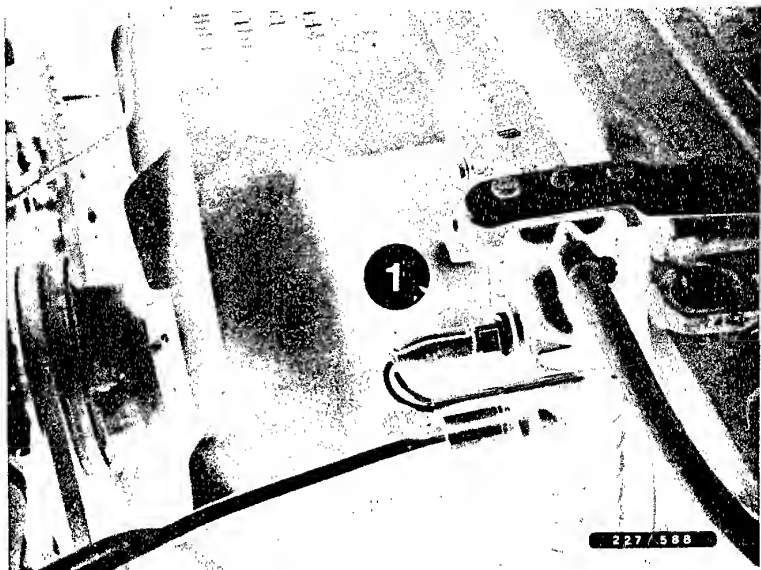
- 1 = Trigger box 2 = Diagnostic connection, "OLD" (1-pin)
 3 = Diagnostic connection, "NEW" (2-pin)

4. Component locations

The control unit is mounted on a heat sink inside the engine compartment (near left-hand wheel well).

The diagnostic connector is located on the wiring harness.





1 = Boiling-protection switch

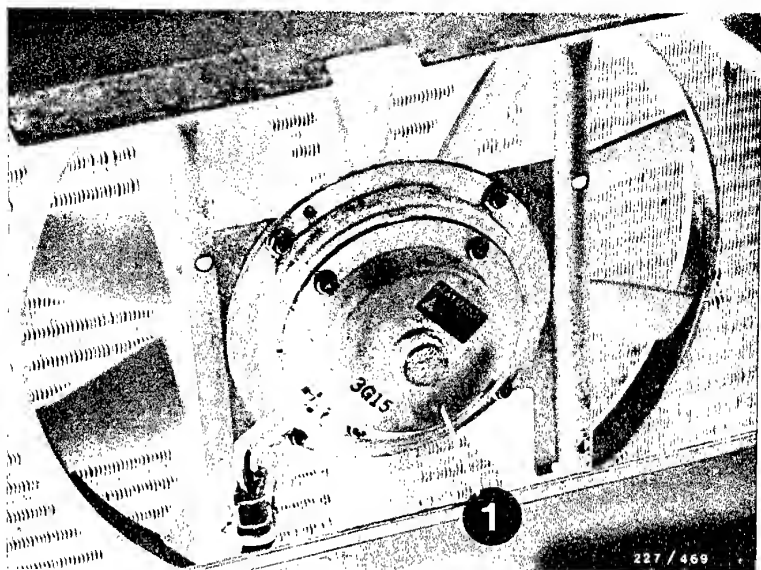
Installed only on vehicle with air conditioner and tropics radiator.

E7

Installation position of components

Volvo





1 = Fan motor (boiling-protection device)

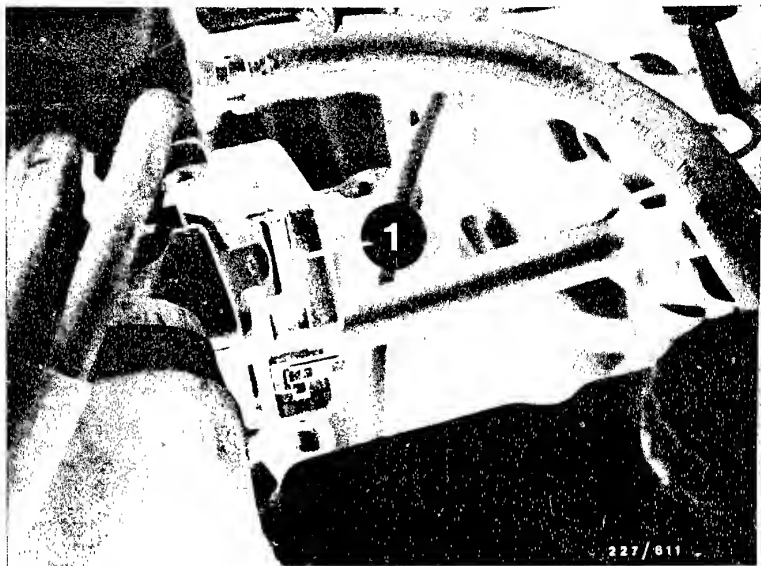
Installed only on vehicle with air conditioner and tropics radiator.

E8

Installation position of components

Volvo



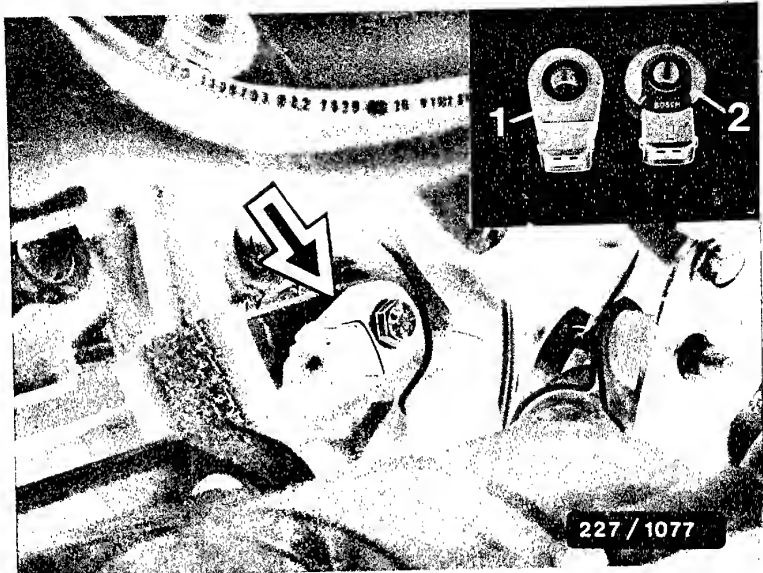


1 = Throttle-valve switch

E9

Installation position of components
Volvo





Arrow = Knock sensor

1 = Old version

2 = New version

The knock sensor is located on the upper part of the engine block (driver's side).

Note:

See above for correct position of knock sensor (connection on side).

Attach mounting bolt of knock sensor w i t h o u t plain washer, spring lock washer, tooth lock washer, etc.

Tightening torque:

Old version 11 ... 15 Nm

New version 15 ... 25 Nm

Secure mounting bolt only with locking paint.

E10

Installation position of components

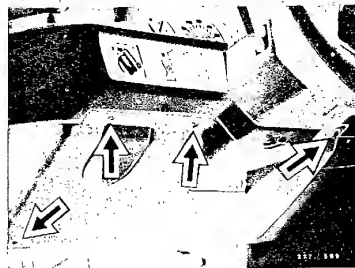
Volvo



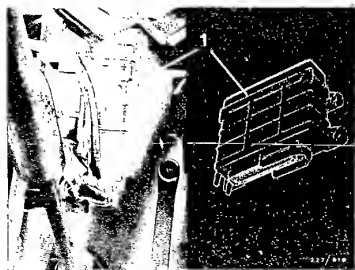
The EZ-K control unit is in the passenger compartment on the left next to the pedal block. See bottom picture.

How to remove:

Remove steering-column cover. See arrow, top picture.



1 = EZ-K control unit



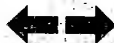
E11

Installation position of components
Volvo



E12

Installation position of components
Volvo

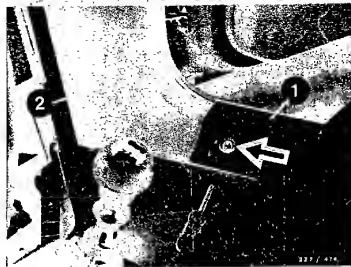


The LH-Jetronic control unit is in the passenger compartment on the right (under glove compartment). See bottom picture.

How to remove:

Unscrew fastening screws from door sill and LH-Jetronic control unit cover. See arrows, top picture.

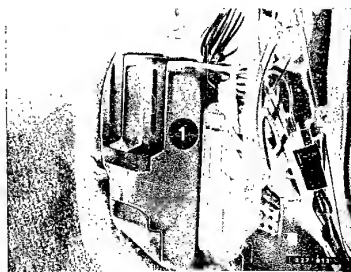
Remove both covers.



1 = Door sill cover

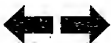
2 = LH-Jetronic control unit cover

1 = LH-Jetronic control unit



E13

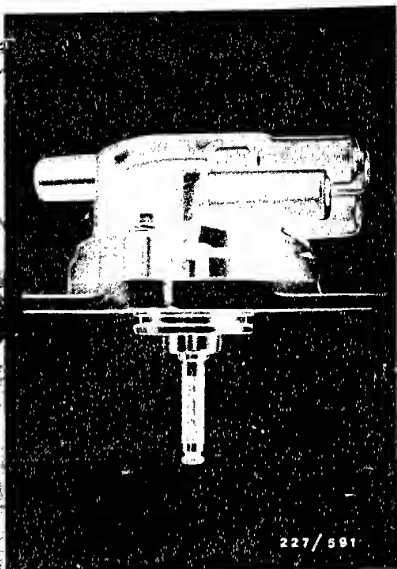
Installation position of components
Volvo



E14

Installation position of components
Volvo





1 = Ignition distributor (with ignition pulse generator)

E15

Installation position of components
Volvo



5. Required test instruments and tools

Engine tester, e.g.	MOT 201	0 684 000 201
Pulse shaper (required for measuring the primary voltage with MOT 201, 202, 206 and 400)		1 684 463 154
Spark discharge tester, e.g. Ignition coil condenser tester	EFAW 106 A	0 681 100 001
or Single spark discharge tester	EF 1177 / 7	1 684 531 000
5 k Ω sleeve-type suppressor		0 356 500 001
Ohmmeter	ETE 014.00	0 684 101 400
or	Pontavi WH 2	commercially available
Voltmeter, e.g.	ETE 014.00	0 684 101 400
Evaluation unit (evaluation of self-diagnosis)		KDAW 9980
Test leads (for proper attachment of test equipment to connectors)		KDZS 0004
Test prods (for proper attachment of test equipment to connectors)		commercially available
Thermal conduction paste		5 942 860 003
Bolt locking paint, 30 g		5 703 245 003
Torque wrench Range: 5 ... 60 Nm		commercially available



Incorrect speed, dwell angle and firing point display

(continuation)

Auxiliary lead for user
fabrication (e.g. to check
anti-boilover function)

Parts required:

approx. 90 mm of 1.5 mm² cable

6 210 ...

2 flat pin terminals

8 784 480 011

6. Incorrect indication of speed, dwell angle and firing point

Incorrect indication of speed, dwell angle and firing point by test equipment may occur in ignition systems with control unit 0 227 T00 124 (TZ-I) incorporating current limitation.

See coordinates N 10 - N 14 for additional information.

7. Hazards in electronic ignition systems

Increased demands placed on ignition systems by modern engines, as well as the desire for reduced maintenance, caused electronic ignition systems to be introduced as standard equipment some time ago.

As a rule, the power supplied by nearly all electronic ignition systems exceeds that of conventional systems, and further increases are expected. Thus electronic ignition systems are within a power range where contact with live parts or terminals can be extremely hazardous (on both the primary and secondary sides).

We therefore recommend that any work or tests performed on the ignition system be in accordance with VDE Regulations (Association of German Electrical Engineers), particularly VDE 0104 dated July, 1967, as well as all pertinent national regulations.



The ignition must always be switched off when work is performed on the ignition system (switch off ignition and/or power supply).

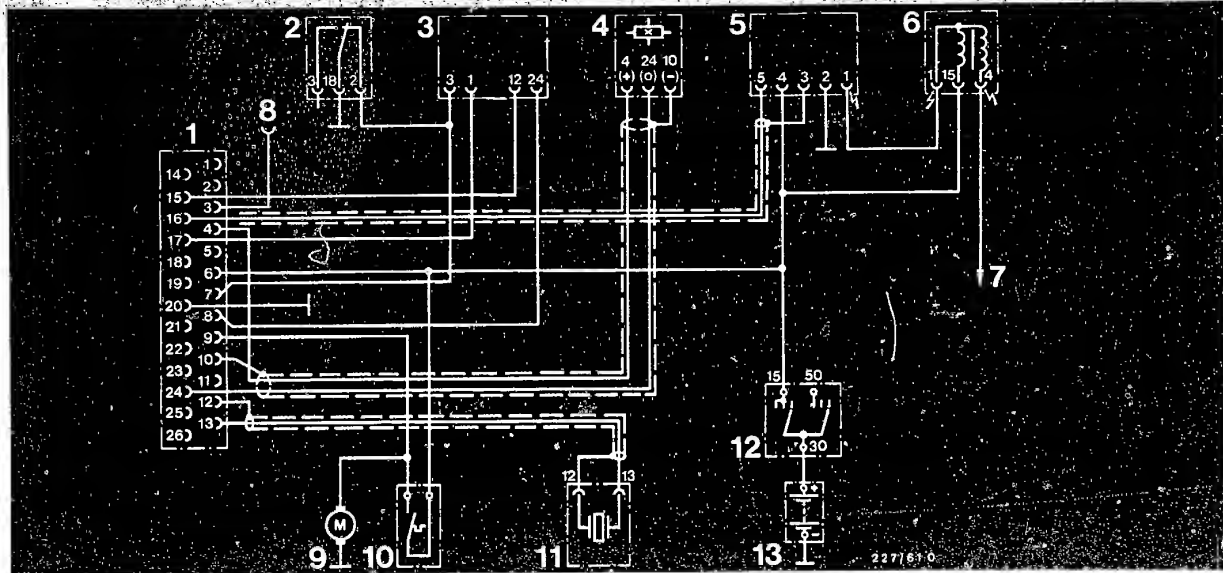
This work includes:

- attaching engine testers (timing light, dwell-tach tester, ignition oscilloscope, etc.)
- replacing ignition system parts (spark plug, ignition coil, ignition distributor, ignition cable, etc.)

If, when checking the ignition system or when performing adjustments of the engine (e.g. LH-Jetronic), it becomes necessary to switch on the ignition (ignition/voltage source), the above-mentioned dangerous voltages occur over the entire system.

Hazards therefore exist not only within the individual subassemblies of the ignition system (e.g. ignition distributor, ignition coil, control unit, ignition harness), but also at the wiring harness (e.g. tachometer connector, diagnostic connector), plug connection cables and test equipment.





Danger arrows: Warning: 400 V ... 25 kV

- 1 = EZ-K Control unit
- 2 = Throttle-valve switch
- 3 = LH-Jetronic control unit
- 4 = Ignition pulse generator

- 5 = Trigger box
- 6 = Ignition coil
- 7 = To ignition distributor
- 8 = Diagnostic connection

- 9 = Fan motor
 - 10 = Boiling-protection switch
 - 11 = Knock sensor
 - 12 = Ignition/starting switch
 - 13 = Battery
-) only for vehicles with air conditioner and tropics radiator

Electrical terminal diagram

The dangerous locations are identified by danger arrows taking the example of the terminal diagram of an electronic ignition system.

E19

Danger of accident
Volvo



E20

Danger of accident
Volvo



8. Important vehicle information

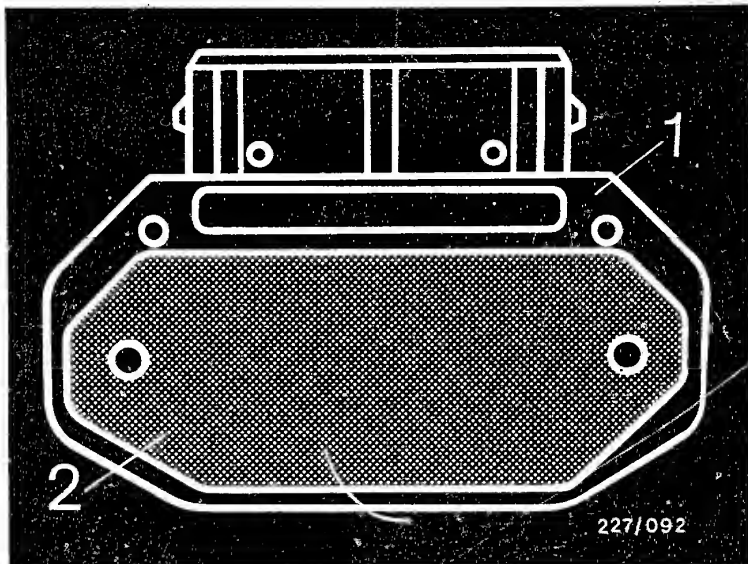
- Conduct resistance measurements only with ignition switched off or battery disconnected (tester defective)
- During compression testing remove control unit plug, or using an auxiliary cable securely connect ignition coil terminal 4 to ground (dangerously high voltage, insulation damage on ignition coil, ignition distributor, ignition harness).

Note:

Auxiliary cable must have at least 2 k Ω suppression, e.g. 5 k Ω sleeve-type suppressor 0 356 500 001.

- Do not replace specified ignition coil (see part No.) with a different type of ignition coil.
- Do not connect a suppression capacitor to ignition coil terminal 1.
- Do not connect ignition coil terminal 1 to ground as an anti-theft measure (when ignition is switched "on" ignition coil will be destroyed).
- Do not connect a positive battery terminal or test lamp to ignition coil terminal 1 (control unit will be destroyed).
- Do not remove the high voltage ignition cable between ignition coil terminal 4 and ignition distributor terminal 4 with the engine running.
- Flashover from ignition coil terminal 4 to ignition coil terminals 1 and 15 must be prevented. The magnetic pulse generator and control unit could be destroyed.





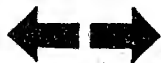
1 = Control unit

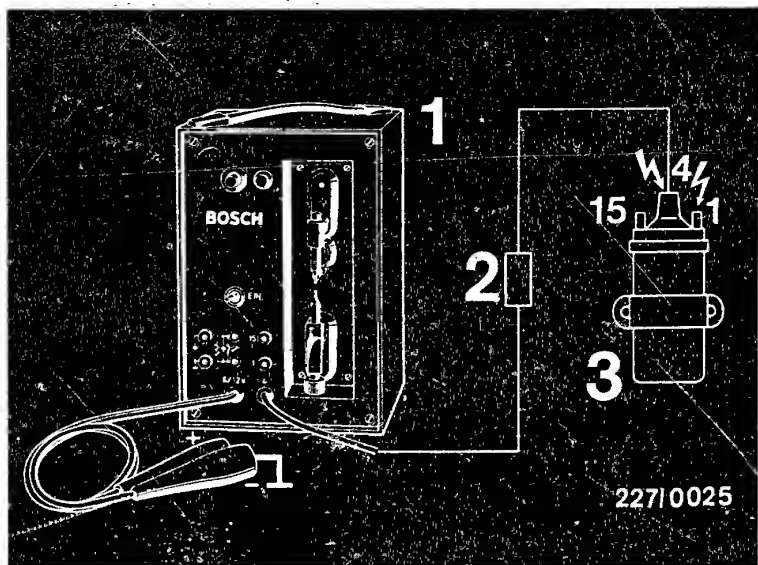
2 = Baseplate

- Coat baseplate with thermal conduction paste before mounting control unit.

Use only suitable object (screwdriver, match, etc.) to apply paste.

Keep thermal conduction paste off painted parts.





1 = Spark discharge tester
2 = 5 kΩ sleeve-type suppressor

3 = Ignition coil

Danger arrows: 400 V ... 25 kV

- To prevent damage to the control unit when using a spark discharge tester, a suppression resistor of at least 2 kΩ must be connected between the spark discharge tester and ignition coil terminal 4 (e.g. 5 kΩ sleeve-type suppressor 0 356 500 001) to prevent damage to the control unit.

E23

Important vehicle information

Volvo



- To prevent damage to the control unit, a suppression resistance of at least 2 k Ω must be connected to the secondary side of the ignition system. The original distributor rotor must be installed with a 1 k Ω suppression resistor (also do not use a 5 k Ω distributor rotor for radio interference suppression).
- Do not attach any external voltage source such as an ohmmeter to the magnetic pulse generator (hall generator).
Use caution when switching meter ranges.
- Leads from ignition pulse generator to EZ-K control unit and from EZ-K control unit to trigger box must be shielded (malfunction of EZ-K control unit/trigger box).
- Flashover or punchthrough at ignition distributor cap (poor insulation) may destroy the magnetic pulse generator and the control unit.
- Do not disconnect battery terminals with engine running.
- Do not assist starting at more than 16 volts or with a fast charger.
- In the case of incorrect battery polarity, ignition pulse generator, trigger box and ignition coil as well as EZ-K control unit will be destroyed.
- Knock sensor cable must be shielded and routed separate from high voltage cables.
- Attach mounting bolt of knock sensor w i t h o u t plain washer, spring lock washer, tooth lock washer, etc. Secure mounting bolt only with locking paint.



9. Troubleshooting

9.1 Using the self-diagnosis system and the self-diagnosis test chart

This vehicle is equipped with an EZ-K control unit which has a self-diagnosis feature (knock control only).

Therefore every test conducted with the engine running must begin with the self-diagnosis system.

Coordinates F5/F6 describe how to activate the system.

The self-diagnosis test chart which begins at coordinates F7/F8 identifies trouble indicators (consisting of flashing code), causes of trouble and test procedures, and gives the coordinates for more specific troubleshooting.

If the self-diagnosis system indicates no trouble but the cause of the customer's complaint has not been eliminated, continue the troubleshooting procedure in accordance with the troubleshooting chart and the troubleshooting sequence beginning at coordinate F9.

9.2 Using the troubleshooting chart

The troubleshooting chart beginning at coordinate F9 lists customer complaints (symptoms), causes of trouble, test procedures and reference coordinates.
Select the possible cause of the trouble which corresponds to the customer's complaint as indicated in the troubleshooting chart.

If the cause of the trouble is unclear, begin testing using the extensive, self-contained troubleshooting sequence beginning at coordinate F15.

If the cause of the trouble can be clearly determined according to the troubleshooting chart, the problem can be pinpointed using the given coordinates without having to go through the entire troubleshooting sequence for each problem.

If no coordinates are given, proceed with troubleshooting using the "test steps" column.

F1

Trouble-shooting / Self-diagnosis

Volvo

**F2**

Trouble-shooting / Self-diagnosis

Volvo



9.3 Using the trouble-shooting program

The troubleshooting program beginning at coordinate F 15 is divided into 3 columns:

The left-hand column gives test steps and test values.

The center column gives instructions for repair.

The right-hand column contains the corresponding figures and wiring diagrams and indicates their locations.

If the questions given in the left-hand column can be answered "yes", go on to the next test directly below.

If a question is answered "no", move over to the center column and conduct the tests listed there.

9.4 Testing requirements

Battery fully charged, fuel system OK, engine in good working order (compression, valve clearance, etc.), ambient temperature or temperature of ignition system between 0 and 100°C (temperature has pronounced effect on measurements).

F3

Trouble-shooting / Self-diagnosis
Volvo

**F4**

Trouble-shooting / Self-diagnosis
Volvo



9.5 Activation of self-diagnosis

Test prerequisite: Engine running at in excess of 1000 min⁻¹

General

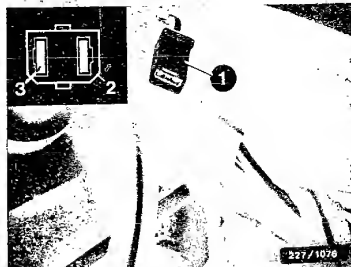
The EI-K control unit features self-diagnosis with diagnosis connection in the engine compartment (see picture).

Only 1 fault is ever indicated with this self-diagnosis.

The first fault detected must be eliminated before further faults can be interrogated.

A total of 2 different faults (knock control only) can be recognized by way of the diagnosis connection in the form of a flashing code.

The flashing pulses are recorded with the evaluation unit KDAW 9980 and assessed (counted) by the person performing the test.



- 1 = Diagnosis connection "old"
2 = Diagnosis connection "new"
3 = Diagnosis terminal post

Activation

Connect socket 1 of evaluation unit to battery term. 30 (+).

Connect socket 2 of evaluation unit to diagnosis connection (see picture).

Switch on ignition.

Lamp of evaluation unit must light up. If lamp does not light up, then perform test step on Coordinate F23/F24.

Then continue activation in accordance with Coordinate F5/F6.

Start engine; run it at in excess of 1000 min-1 and then at idle.

Lamp of evaluation unit flashes depending on fault.

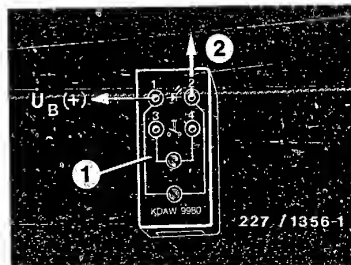
The flashing code can be evaluated and the fault eliminated using the self-diagnosis test table (Coordinate F7/F8).

Note: There is a pause after every diagnosis run (lamp OFF).

Diagnosis runs including pauses are repeated until ignition is switched off. This likewise clears the fault stored in the EI-K control unit.

Self-diagnosis activation with subsequent fault elimination must be repeated until no further flashing code is indicated (knock control is then O.K.).

- 1 = Evaluation unit EFAW 9980
2 = to diagnosis connection



Self-diagnosis checking table

Fault indication Flashing code	Cause of fault	Test instructions	Coordinates
No flashing code	Knock control O.K.	-----	-----
1 Not used	-----	-----	-----
2 Not used	-----	-----	-----
3 Not used	-----	-----	-----
4	Knock control defective	Check knock sensor (mounting of knock sensor, open circuit/short circuit), or EZ-K control unit defective.	G 15
5	Load signal (LH-Jetronic) not O.K.	Check load signal	G 21

F7

Trouble-shooting / Self-diagnosis
Volvo



F8

Trouble-shooting / Self-diagnosis
Volvo

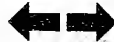


9.6 Troubleshooting chart

Customer complaint (symptom)

1. Starter engages, engine does not start
 2. Rough idle
 3. Engine gets no gas (flow problem)
 4. Poor engine performance
 5. Engine misfires
 6. Fuel consumption too high
 7. Engine pings or knocks
 8. Faulty ignition
 9. Engine runs too hot

										Cause of trouble	Test steps	Coordinates
•	•	•	•	•	•	•	•	•	•	Unclear	Perform thorough troubleshooting	F 15
•	•	•	•	•	•		•			Spark plugs defective	Evaluate ignition oscilloscope trace or remove and visually check spark plug	----
		•	•	•	•					Suppression resistors defective	Evaluate oscilloscope trace or measure resistance	----
•	•	•	•	•						Shunt on secondary side	Check ignition coil, ignition distributor, ignition harness and spark plug by means of oscilloscope trace or visual check	----
•	•	•	•	•						Open circuit on secondary side	Check ignition coil, ignition distributor, ignition harness and spark plug by means of oscilloscope trace or check continuity using ohmmeter	----
•										Open circuit on primary side	---	J 1
•	•	•	•	•						Ignition coil defective	---	F 17



Trouble-shooting chart (continued)

Customer complaint (fault symptom)

1. Starting motor operates, engine fails to start

2. Rough idle

3. Poor throttle take-up (flat spot on acceleration)

4. Insufficient engine power

5. Misfiring

6. Fuel consumption too high

7. Engine pinging/knocking

8. Backfiring

9. Engine overheating

Cause of fault

Test instructions

Coordinates

●	●					●	Firing sequence incorrect	Firing sequence 1 - 3 - 4 - 2	-----
●							Contact resistance at trigger box/ EZ-K control unit not O.K.	-----	F 19
		●		●			Microswitch idle contact defective	-----	G 1
	●	●	●	●	●	●	Basic ignition timing incorrect	To prevent incorrect setting, see coordinates for testing.	G 1...G 8
						●	Control lead/boiling-Protection switch defective	-----	G 9
						●	Fan motor defective	-----	G 11
						●	Boiling-protection function not O.K. (on B 230FT engine only)	-----	G 13

F11

Trouble-shooting/Trouble-shooting chart
Volvo



F12

Trouble-shooting/Trouble-shooting chart
Volvo



Trouble-shooting chart (continued)
Customer complaint (fault symptom)

1. Starting motor operates, engine fails to start

2. Rough idle

3. Poor throttle take-up (flat spot on acceleration)

4. Insufficient engine power

5. Misfiring

6. Fuel consumption too high

7. Engine pinging/knocking

8. Backfiring

9. Engine overheating

Cause of fault

Test instructions

Coordinates

Knock sensor or EZ-K control unit defective

G 15

Load signal from LH-Jetronic not O.K.

G 21

Trigger box power supply defective

J 1

EZ-K control unit power supply defective

J 3

Ignition pulse generator defective

J 5...J 10

EZ-K control unit defective

J 11

Abnormal engine noises

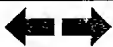
Engine mechanically defective
(bearing damage, valve spring broken
etc)

Fuel consumption not O.K.

Fuel with insufficient octane number

F13

Trouble-shooting/Trouble-shooting chart
 Volvo



F14

Trouble-shooting/Trouble-shooting cart
 Volvo



9.7 Trouble-shooting program

Check primary signal.

If oscilloscope or tachometer tester not available, check for ignition spark on spark discharge tester.

Primary signal with oscilloscope

Connect oscilloscope to ignition coil as per operating instructions. Start engine. Oscilloscope must indicate primary voltage (magnitude not important).

Primary signal with tachometer tester

Connect tachometer tester to ignition coil as per operating instructions. Start engine.

Tachometer tester must register a value (magnitude not important).

Ignition spark with spark discharge tester

Remove high tension ignition cable at terminal 4 of ignition coil.

Connect spark discharge tester with sleeve-type suppressor (5 k Ω) to ignition coil.

Set spark gap to 5 mm.

Start engine.

Sparks must appear across spark gap.

Are primary signal and/or ignition sparks in spark gap present?

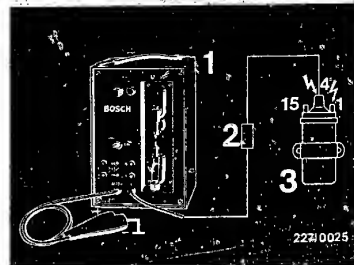
yes

Continued on F17/F18

no

If no primary signal or ignition spark is present, continue test at coordinate J 1.

Test beginning at F 17 not necessary.



1 = Spark discharge tester

2 = 5 k Ω sleeve-type suppressor

3 = Ignition coil

Danger arrows: Warning: 400 V...25 kV

F15

Trouble-shooting program

Volvo



F16

Trouble-shooting program

Volvo



yes

Check distributor cap, distributor rotor, high tension ignition cables and spark plugs.

Is high voltage side OK?

no

Repair high voltage side.

yes

Check ignition coil.

Visual check:

Remove protective cap from ignition coil and check for presence of plug and any leakage of sealing compound.

Electrical check:

Ignition coil, primary (term. 15 and term. 1) 0,6...1,0 Ω (take resistance of test lead/test prods into account).

Ignition coil, secondary (term. 1 and term. 4) 6,4 ... 11,4 k Ω .

Plug present and no sealing compound leakage?

Is resistance value OK?

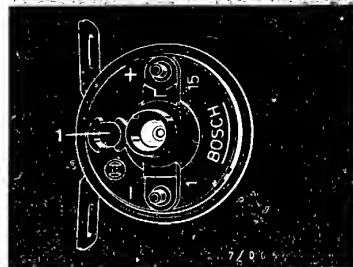
no

1. If the plug is missing and sealing compound has leaked, replace control unit, anti-knock control unit and ignition coil.

2. If resistance values not OK, replace ignition coil.

yes

Continued on F19/F20



1 = Plug

F17

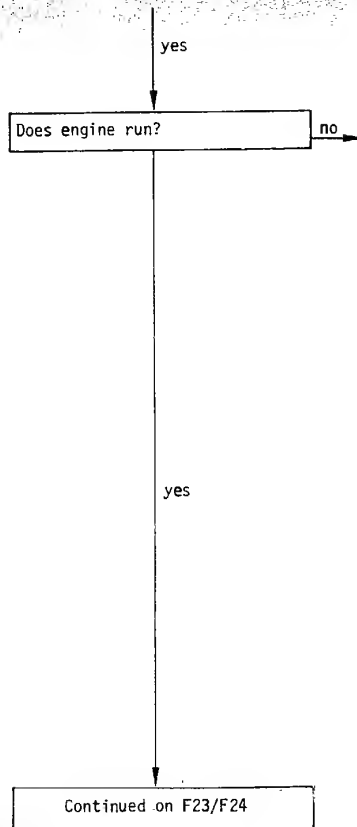
Trouble-shooting program
Volvo



F18

Trouble-shooting program
Volvo





Step 1

Disconnect positive and negative battery cables. Disconnect trigger-box plug after pressing wire retainer. Switch on ignition.

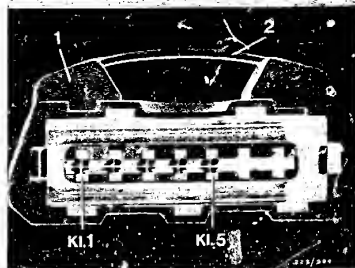
Check leads from positive battery terminal to control unit connector terminal 4 and from negative battery terminal to control unit connector terminal 2 for contact resistance. Max. total contact resistance 0.3Ω (take resistance of test lead/test prods into account). Eliminate contact resistance.

Check leads from positive battery terminal to ignition coil terminal 15 and the lead from ignition coil terminal 1 to control unit connector terminal 1 for contact resistance. Max. total contact resistance 0.3Ω (take resistance of test lead/test prod into account). Eliminate contact resistance.

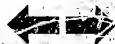
Step 2

Reconnect battery. Attach dwell angle tester to ignition coil as per operating instructions. Start engine. Dwell angle tester must indicate 27 ... 33% (only during starting). If dwell angle not correct, replace EZ-K control unit.

If steps 1 and 2 were OK, replace control unit.



1 = Trigger-box plug
2 = Wire retainer



Continued

3. Test step

Disconnect LH-Jetronic control-unit plug. See arrow, upper illustration.

Connect oscilloscope set to "Special" program-selector-switch position in accordance with operating instructions.

For example, MOT 201:
Connect red terminal to LH-Jetronic control-unit plug term. 1 (test signal). See upper illustration.

Black plug to vehicle ground.

Crank engine.

Oscilloscope must indicate rectangular pulse. See center illustration.

If no rectangular pulse is indicated, disconnect EI-K control-unit plug.
See lower illustration.

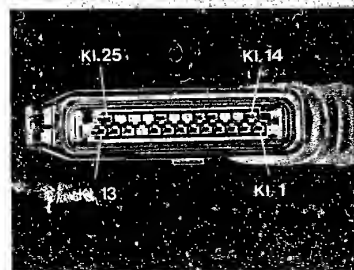
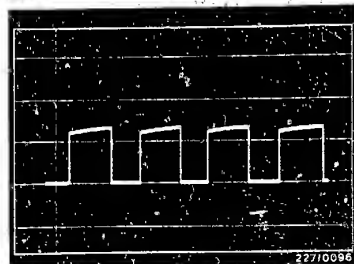
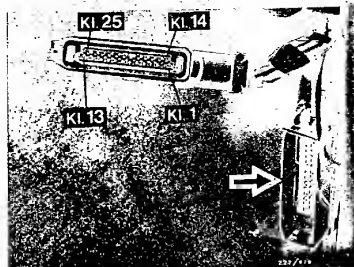
Check lead from EI-K control-unit plug term. 17 to LH-Jetronic control-unit plug term. 1 for open circuit.

Eliminate open circuit.

If no open circuit is present, replace EI-K control unit.

yes

Continued on F23/F24



F21

Trouble-shooting program

Valve



F22

Trouble-shooting program

Valve



yes

Check diagnosis connector

1. Connect evaluation unit KDAW 9980 to battery positive and diagnosis connection (see top picture). Switch on ignition (do not start engine). Fault lamp (evaluation unit) must light up.

2. Start engine and briefly run up to $> 1000 \text{ min}^{-1}$. Then run at idle. Fault lamp is OFF or may indicate flashing pulses.

Is voltage under 1 and 2 above OK?

no

1. If fault lamp did not light up in item 1, disconnect EI-K control-unit plug (bottom picture) and examine lead from EI-K control-unit plug term. 3 to diagnosis connection for open-circuit.

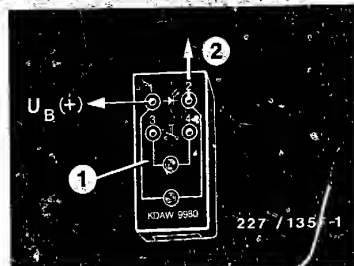
Eliminate open circuit.

If there was no open circuit, replace EI-K control unit.

2. If fault lamp lights up continuously in item 2, check lead from EI-K control-unit plug term. 3 to diagnosis connection for short-circuit to ground.

Eliminate short circuit to ground.

If there was no short circuit to ground, replace EI-K control unit.

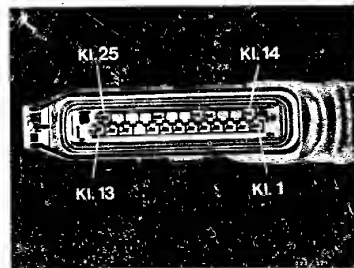


1 = Evaluation unit KDAW 9980
2 = to diagnosis connection

yes

Continued on G1/G2

EI-K control unit



F23

Trouble-shooting program

Volvo



F24

Trouble-shooting program

Volvo



yes

Check basic ignition timing.

Switch off ignition. Disconnect EZ-K control unit plug. See top picture.

Connect voltmeter to disconnected EZ-K control-unit plug term. 6 (+) and term. 7 (-). Throttle valve is in idle position.

Switch on ignition.

Voltmeter must indicate battery voltage.

Open throttle valve 1...2° (idle contact is open).

Voltmeter must now indicate < 10 V.

Are voltage values OK?

yes

Continued on G5/G6

Switch off ignition.

Disconnect throttle-valve switch plug after pressing the wire retainer. See bottom picture.

Connect ohmmeter to the following one after the other:

throttle valve switch connector EZ-K control-unit plug

term. 2 and term. 7

Ohmmeter must indicate approx. 0 Ω (continuity).

If $\infty \Omega$ is indicated, eliminate discontinuity.

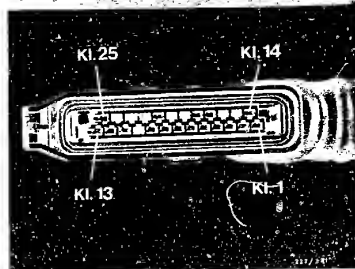
throttle valve switch connector battery

term. 18 and term. 31

Ohmmeter must indicate approx. 0 Ω (continuity).

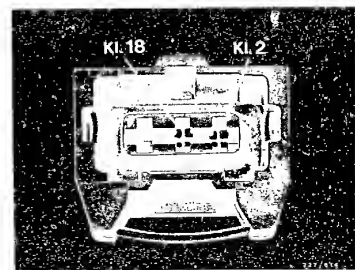
If $\infty \Omega$ is indicated, eliminate discontinuity.

Continued on G3/G4



EZ-K control-unit plug

Throttle valve switch connector



G1

Trouble-shooting program

Volvo



G2

Trouble-shooting program

Volvo



Continued

Attach throttle valve switch connector.

Connect voltmeter to disconnect EZ-K control-unit plug term. 6 (+) and term. 7 (-).

Switch on ignition.

Lightly loosen throttle-valve switch fastening screws (bottom picture) and turn throttle-valve switch in a counterclockwise direction until idle contact audibly clicks and the voltmeter indicates approx battery voltage.

If no battery voltage is indicated, replace the throttle valve switch.

Adjustment check:

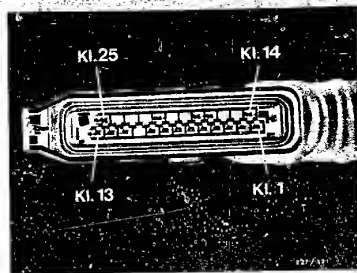
Open throttle valve slightly.

Idle contact must click audibly.

Voltmeter must indicate 0 V.

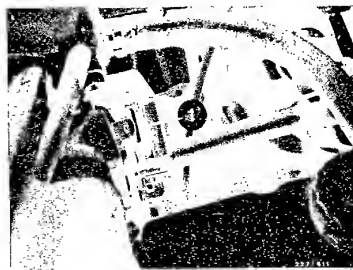
yes

Continued on G5/G6



EZ-K control-unit plug

1 = Throttle valve switch connector



G3

Trouble-shooting program
Volvo



G4

Trouble-shooting program
Volvo



yes

Check basic ignition timing.

Only on vehicle with air conditioner and tropics radiator, disconnect plug from boiling-protection switch. See arrow, top picture.

Vehicle with automatic transmission.
Selector lever in position "P/N".
Start engine and operate briefly at speed $>1000 \text{ min}^{-1}$ and then at $750 \dots 1000 \text{ min}^{-1}$.

Caution:

Throttle-valve switch (idle contact) must be closed.
(In case of clearly incorrect reading of engine speed of testers, connect in series resistor or convert motortester).

Aim timing light at ignition mark.

Basic ignition timing must be $12 \pm 1^\circ \text{ BTDC}$.

See center picture.

Basic ignition timing O.K.?

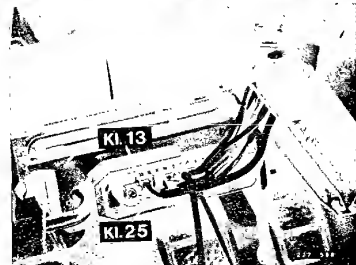
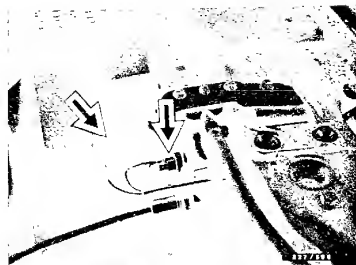
no

1. Switch off ignition. Remove EZ-K control unit and disconnect plug. Push back handle cover of EZ-K control-unit plug after unscrewing fastening screws and removing sealing rubber. Connect EZ-K control-unit plug. See bottom picture. Connect voltmeter, positive to EZ-K control-unit plug term. 9 and negative to term. 20. Run engine at idle. Voltmeter must indicate approx 0 V. If battery voltage indicated, eliminate positive connection.

yes

Continued on G9/G10

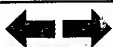
Continued on G7/G8



G5

Trouble-shooting program

Volvo



G6

Trouble-shooting program

Volvo



Continued

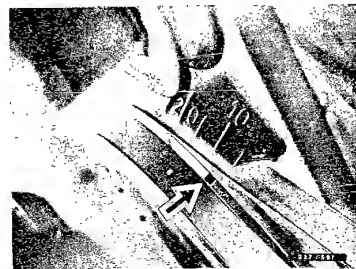
2. If there was no positive connection, loosen ignition distributor mounting (arrow, top picture) and turn ignition distributor until $12 \pm 1^\circ$ BTDC is obtained.

yes

Continued on G9/G10



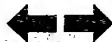
Ignition timing mark



G7

Trouble-shooting program

Volvo

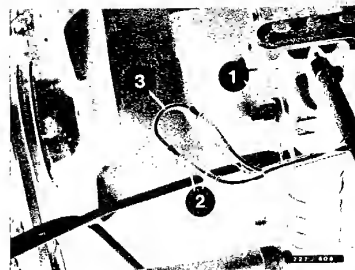
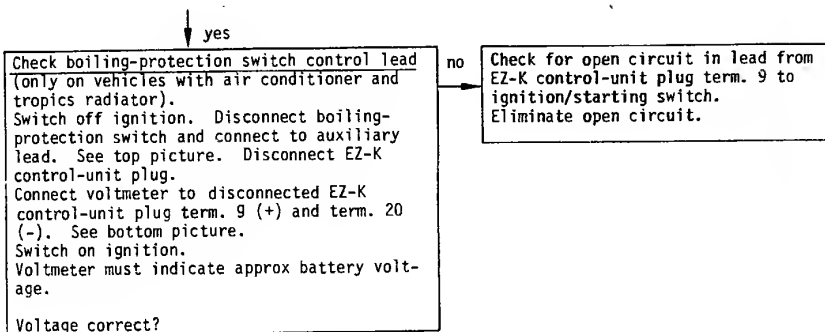


G8

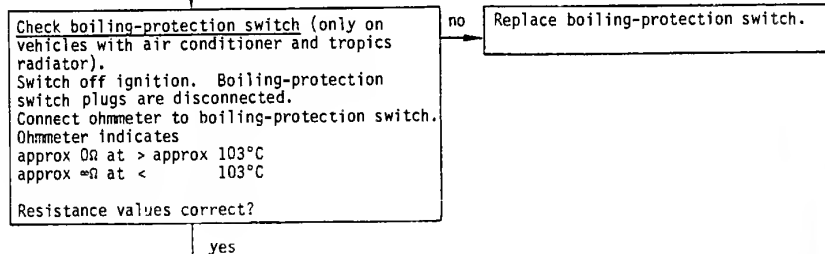
Trouble-shooting program

Volvo

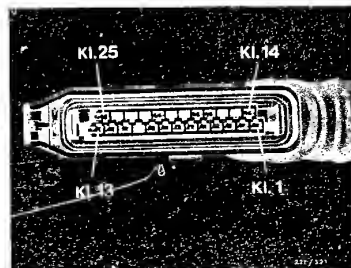




- 1 = Boiling-protection switch
2 = Boiling-protection switch plug
3 = Auxiliary lead



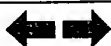
EZ-K control-unit plug



Continued on G11/G12

G9

Trouble-shooting program
Volvo



G10

Trouble-shooting program
Volvo



yes

Check fan motor
(only on vehicles with air conditioner and
tropics radiator).

Remove both anti-boilover switch
connectors and bridge them with an
auxiliary lead. See top photograph.

Switch on ignition.

Fan motor must run.

Does fan motor run?

no

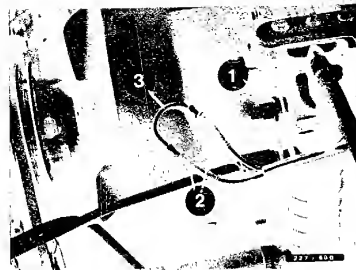
Check lead from anti-boilover
switch connector to fan motor
and motor ground connection
for continuity.

Eliminate discontinuity.

If no discontinuity is found,
replace fan motor.

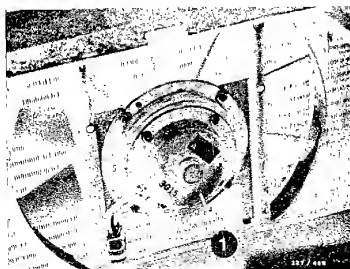
yes

Continued on G13/G14



- 1 = Anti-boilover switch
- 2 = Anti-boilover switch
connector
- 3 = Auxiliary lead

Fan motor



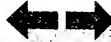
G11

Trouble-shooting program
Volvo



G12

Trouble-shooting program
Volvo



yes

Check boiling-protection function (only on engine 230 FI or vehicle with air conditioner and tropics radiator.
Disconnect boiling-protection switch plug and connect to auxiliary lead. See top picture.

no

Replace EZ-K control unit.

Start engine and run briefly at speed $> 1000 \text{ min}^{-1}$ and then at idle.

(In case of clearly incorrect reading of engine speed on testers, connect in series resistor or convert motortester).

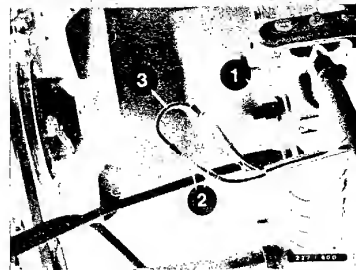
Aim timing light at ignition mark.

Spark advance must be 23 ... 27° BTDC.

Spark advance correct?

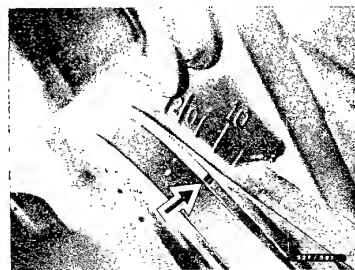
yes

Continued on G15/G16



- 1 = Boiling-protection switch
- 2 = Boiling-protection switch plug
- 3 = Auxiliary lead

Ignition timing mark



G13

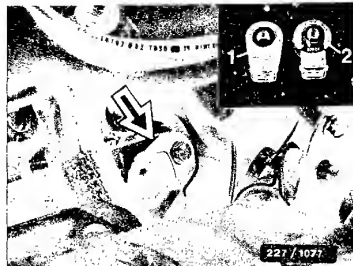
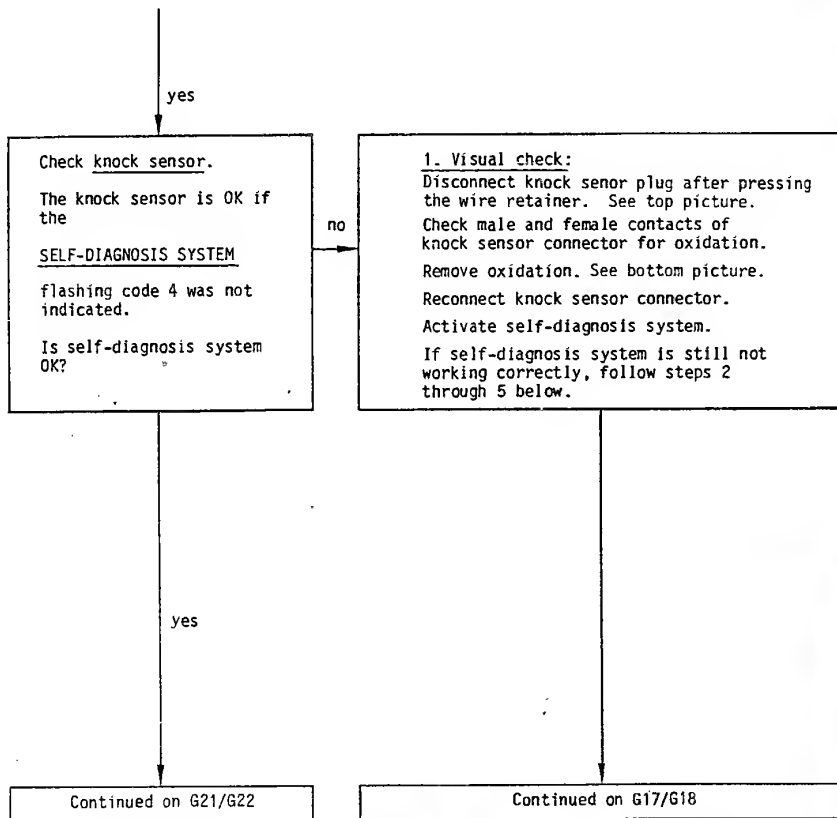
Trouble-shooting program
Volvo



G14

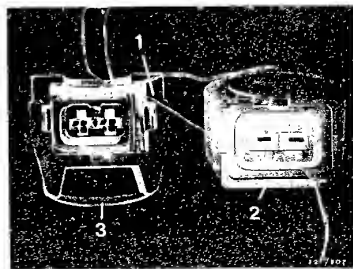
Trouble-shooting program
Volvo





Arrow = Knock sensor
1 = Old version
2 = New version

1 = Knock sensor plug
2 = Knock sensor socket
3 = Wire retainer



Continued

Switch off ignition.
Disconnect knock sensor plug and EZ-K control-unit plug.

2. Connect ohmmeter to:
Knock sensor plug EZ-K control-unit plug
Term. 12 and term. 12
Term. 13 and term. 13
Ohmmeter must indicate approx 0 Ω (continuity).
Eliminate open circuit.

3. Connect ohmmeter to:
Knock sensor plug EZ-K control-unit plug
Term. 13 and term. 20
Ohmmeter must indicate $\infty \Omega$. If ohmmeter indicates approx 0 Ω (continuity), eliminate short circuit to ground between knock sensor lead term. 13 and term. 20.

4. Conduct only on the "old" knock-sensor version.
Connect knock-sensor plug and connect ohmmeter to:
EZ-K control-unit plug EZ-K control-unit plug
Term. 12 and term. 13

Ohmmeter must indicate 270...330 k Ω
If resistance value not correct, replace knock sensor.

yes

Continued on G21/G22

Continued on G19/G20

Kl.13 Kl.12

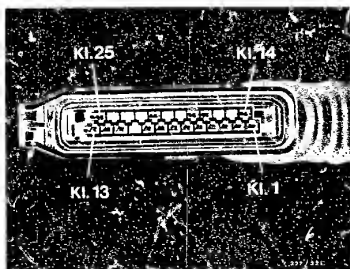


Knock sensor plug

EZ-K control-unit plug

Kl.25 Kl.14

Kl.13 Kl.1



G17

Trouble-shooting program
Volvo



G18

Trouble-shooting program
Volvo



Continued

5. Tightening torque:

Old version 11 ... 15 Nm

New version 15 ... 25 Nm

If points 1 ... 5 O.K.,

replace knock sensor.

Self-diagnosis reactivates.

If flashing code 4 is still indicated,
re-install previously removed knock sensor
and renew EI-K control unit.



Arrow = Knock sensor

1 = Old version

2 = New version

yes

Continued on G21/G22

G19

Trouble-shooting program

Volvo

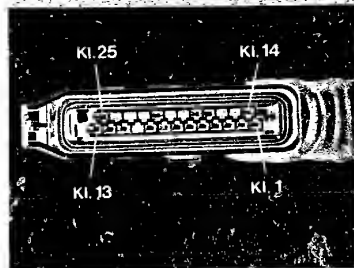
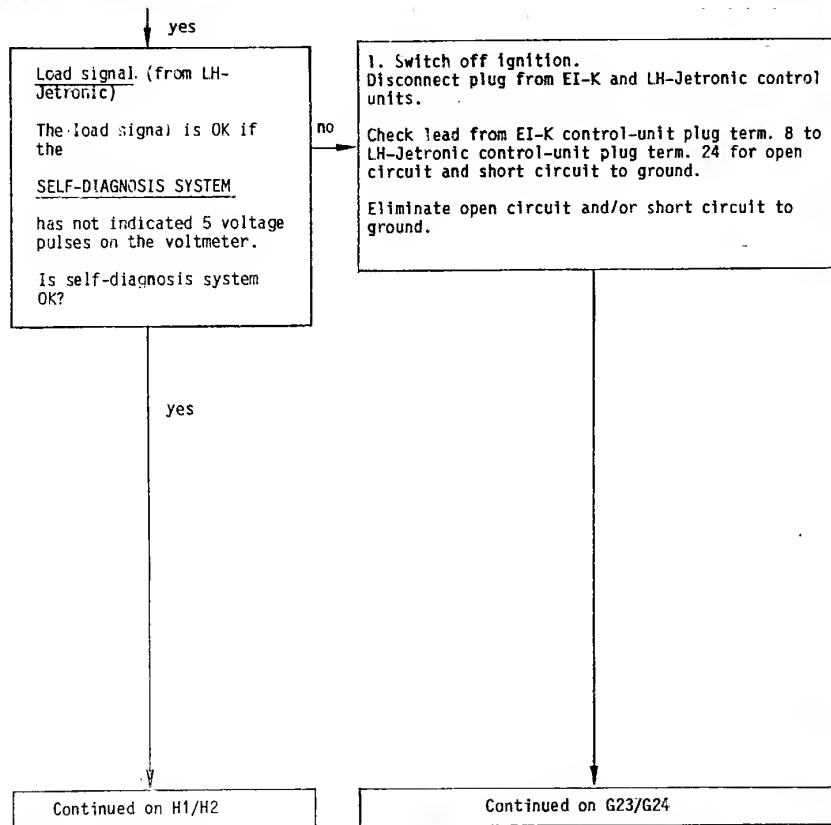


G20

Trouble-shooting program

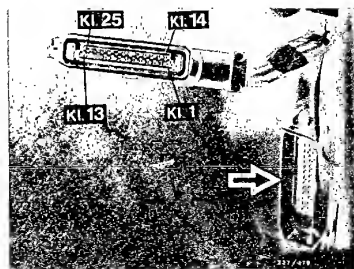
Volvo





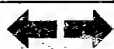
EI-K control-unit plug

LH-Jetronic control-unit plug



G21

Trouble-shooting program
Volvo



G22

Trouble-shooting program
Volvo



Continued

2. Push back handle cover of EI-K control-unit plug after unscrewing the fastening screws and removing the sealing rubber. See illustration.

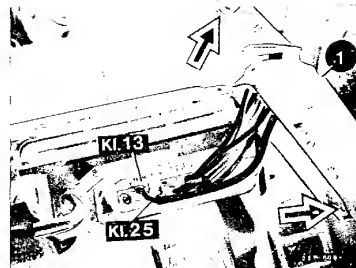
Connect EI-K and LH-Jetronic control-unit plugs.

Connect ANALOG VOLTMETER to EI-K control-unit plug term. 8 (+) and vehicle ground. See illustration. Run engine at idle speed.

Briefly depress accelerator pedal to floor (snap acceleration).
Voltmeter must indicate 0.1...1.0 V. If set value O.K., replace EI-K control unit.
If set value not O.K., check LH-Jetronic in accordance with SIS.
If LH-Jetronic was O.K., try replacing EI-K or LH-Jetronic control unit.

yes

Continued on H1/H2



1 = Handle cover
Arrows = Fastening screws

G23

Trouble-shooting program

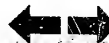
Volvo



G24

Trouble-shooting program

Volvo



yes

Check trigger box power supply.
Remove top part of air filter.
Remove trigger box with heat sink. Push back rubber sleeve on trigger-box plug. Connect voltmeter with test prods to trigger-box plug term. 4 (+) and term. 2 (-). See top picture.
Operate engine at idle. Measured voltage must be 12 ... 14 V and may be no more than 1 V below battery voltage.

Voltage correct?

yes

Check ignition coil power supply.

Connect voltmeter to ignition coil term. 15 and negative battery terminal. Operate engine at idle. Measured voltage must be 10 V.
Voltage correct?

yes

Continued on H3/H4

Disconnect negative and positive cables from battery. Disconnect trigger-box plug after pressing wire retainer. Switch on ignition.

Check for contact resistance in leads from positive battery terminal to trigger-box plug term. 4 including leads between negative battery terminal and trigger-box plug term. 2. Total contact resistance max. 0.3 Ω (take resistance of test lead and test prods into account).

Eliminate contact resistance.

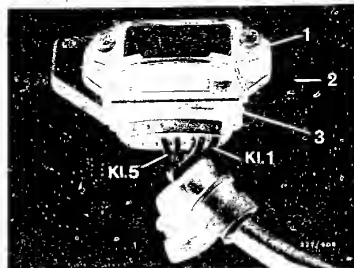
no

Disconnect positive cable from battery. Switch on ignition.

Check for contact resistance in leads between positive battery terminal and ignition coil term. 15. Contact resistance max. 0.3 Ω . (Take resistance of test lead and test prods into account.)

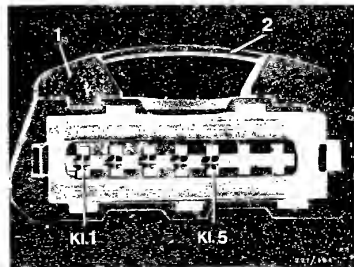
Eliminate contact resistance.

no



- 1 = Trigger box
- 2 = Heat sink
- 3 = Trigger-box plug

- 1 = Trigger-box plug
- 2 = Wire retainer



H1

Trouble-shooting program
Volvo



H2

Trouble-shooting program
Volvo



yes

Check primary voltage.

(if MOT series oscilloscope available)

Connect oscilloscope (e.g. MOT 201) together with pulse shaper 1 684 463 154 to ignition coil in accordance with operating instructions.

Note: Incorrect measured value without pulse shaper.

Run engine at idle.

The primary voltage must be 295 ... 365 V (see illustration).

Is voltage value OK?

no

Replace control unit.

yes

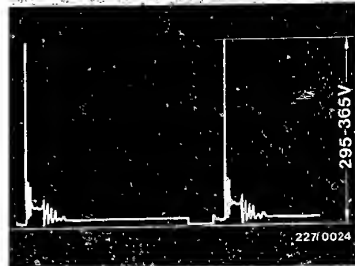
Ignition system OK

Test completed.

Test beginning at coordinate J 1 not necessary.

Note:

If customer complaint still exists, fault may be in fuel system or engine may have mechanical problem.



H3

Trouble-shooting program
Volvo



H4

Trouble-shooting program
Volvo



No primary signal or no ignition
spark

(Continued from F15/F16)

yes

Check voltage from control unit.
Remove top part of air filter.
Disconnect trigger-box plug after
pressing wire retainer.
Connect positive lead of voltmeter to
terminal 4 and negative lead to
terminal 2 of control unit connector.
Switch on ignition.
Voltmeter must indicate battery
voltage. Is voltage value O.K.?

no

Check leads and connections
between ignition/starter
switch and control unit con-
nector terminal 4 and ground
lead terminal 2 for discon-
tinuity.
Eliminate discontinuity.

yes

Check primary circuit.

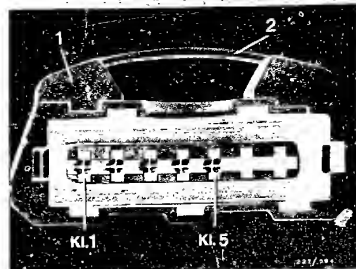
Connect positive lead of voltmeter to
terminal 1 and negative lead to
terminal 2 of unplugged control unit
connector.
Switch on ignition.
Voltmeter must indicate battery
voltage.
Is voltage value OK?

no

Check lead from ignition/starter
switch to ignition coil term-
inal 15, the primary winding of
the ignition coil, and the lead
from ignition coil terminal 1 to
control unit connector terminal
1 and ground lead terminal 2 for
continuity.
Eliminate discontinuity.

yes

Continued on J3/J4



1 = Trigger-box plug
2 = Wire retainer

J1

Trouble-shooting program

Volvo



J2

Trouble-shooting program

Volvo



yes

Check EZ-K control unit power supply.

Switch off ignition.

Disconnect EZ-K control-unit plug.

Connect voltmeter to EZ-K control-unit plug
term. 6 (+) and term. 20 (-).

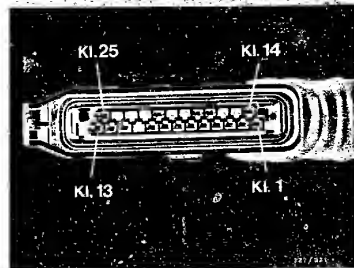
Switch on ignition.

Voltmeter must indicate battery voltage.

Is voltage OK?

no

Check for open circuit in lead from
ignition/starting switch to EZ-K
control-unit plug term. 6 including
ground lead term. 20.
Eliminate discontinuity.



EZ-K control-unit plug

yes

Continued on J5/J6

J3

Trouble-shooting program
Volvo



J4

Trouble-shooting program
Volvo



yes

Check male and female halves of
ignition distributor connector.

Disconnect ignition-distributor plug
after pressing wire retainer (arrow).

Unplug ignition distributor connector.

Visual check:

Check male and female contacts of
ignition distributor connector for
oxidation.

Remove oxidation.

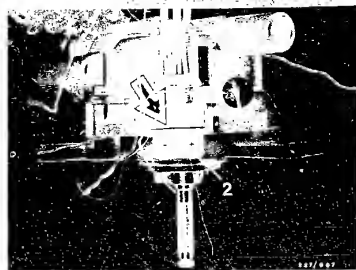
Reconnect ignition distributor
connector.

Start engine.

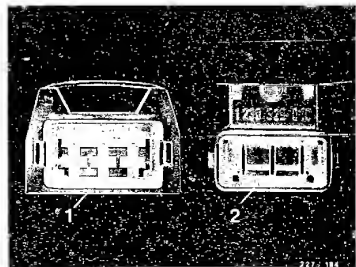
If no primary signal or ignition
spark, continue test.

yes

Continued on J7/J8



- 1 = Male ignition distributor
connector
2 = Female ignition distributor
connector



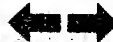
J5

Trouble-shooting program
Volvo



J6

Trouble-shooting program
Volvo



yes

Check ignition pulse generator. Switch off ignition.
Remove EZ-K control unit and disconnect plug. Push back handle cover of EZ-K control-unit plug after unscrewing fastening screws and removing sealing rubber. See top picture. Connect EZ-K control-unit plug. Connect oscilloscope in accordance with operating instructions with program switch in "special" position.
For example, MOT 201:
Red clamp to EZ-K control-unit plug term. 24 (measured signal). Black clamp to vehicle ground.
Start engine.
Oscilloscope must indicate rectangular pulse. See bottom diagram.

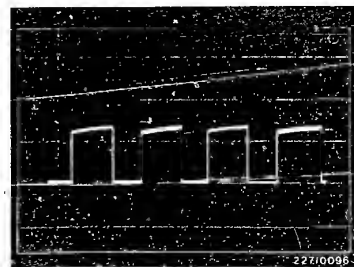
Rectangular pulse present?

no

1. Connect voltmeter to EZ-K control-unit plug term. 4 (+) and term. 10 (-).
Switch on ignition.
Voltmeter must indicate > 10 V.
If < 10 V indicated, replace EZ-K control unit.

1 = Handle cover
Arrow = Fastening screws

Rectangular pulse



Continued on J11/J12

Continued on J9/J10

J7

Trouble-shooting program

Volvo



J8

Trouble-shooting program

Volvo



Continued

2. Switch off ignition.
Disconnect ignition-distributor plug and EZ-K control-unit plug.
Connect ohmmeter, one after the other, to:

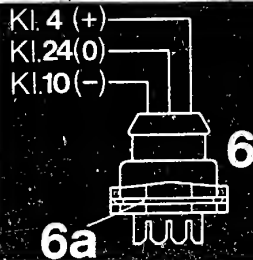
<u>Ignition-distributor plug</u>		<u>EZ-K control-unit plug</u>
Term. 4	and term. 4	
Term. 10	and term. 10	
Term. 24	and term. 24	

In each case, ohmmeter must indicate approx 0Ω (continuity).
Eliminate open circuit.

If there was no open circuit, replace ignition pulse generator/ignition distributor.

yes

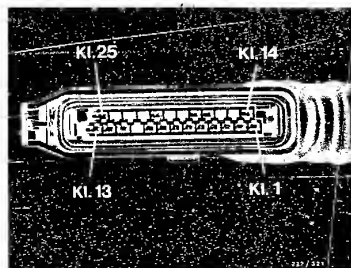
Continued on J11/J12



227 / 617

6 = Ignition-distributor plug
6a = Wire retainer

EZ-K control-unit plug



227 / 529

J9

Trouble-shooting program
Volvo



J10

Trouble-shooting program
Volvo



yes

Check EZ-K control unit.

EZ-K control-unit plug and ignition-distributor plug connected.

Connect oscilloscope set to "special" range as per operating instructions.

For example MOT 201:

Red clamp to disconnected trigger-box plug term. 5 (measured signal).

Connect black lead to ground.

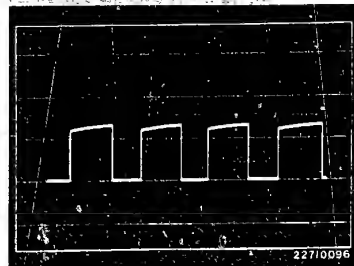
Start engine.

Oscilloscope must display square wave.
See illustration.

Is square wave displayed?

no

Disconnect trigger-box plug and EZ-K control-unit plug.



Square wave

yes

Continued on J15/J16

Continued on J13/J14

J11

Trouble-shooting program
Volvo



J12

Trouble-shooting program
Volvo



Continued

Connect ohmmeter to the following one after the other:

Control unit
connector

EZ-K control-unit plug

term. 5

term. 16

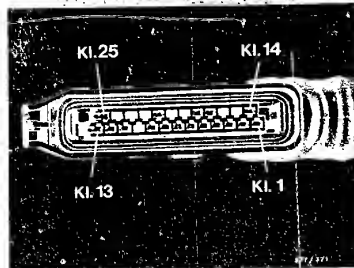
Ohmmeter must indicate approx. 0Ω
(continuity) in each case.

Eliminate discontinuity.

If there was no open circuit, replace EZ-K
unit.

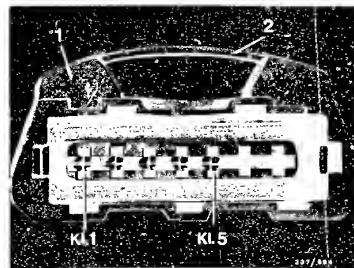
yes

Continued on J15/J16



EZ-K control-unit plug

- 1 = Trigger-box plug
2 = Wire retainer



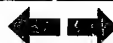
J13

Trouble-shooting program
Volvo



J14

Trouble-shooting program
Volvo



yes

Check ignition coil.

Visual examination:

Check whether plug (see picture) is present and whether sealing compound has escaped.

Electrical test:

Ignition coil, primary
(Term. 15 and term. 1) $0.6...1.0\Omega$ (take resistance of test lead and test prods into account).

Ignition coil, secondary
(Term. 1 and 4) $6.4...11.1\text{ k}\Omega$.

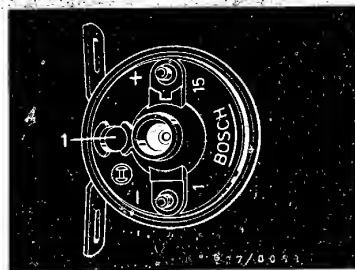
Plug present and/or no sealing compound escaped?

Resistance value correct?

no

1. If plug not present and/or sealing compound escaped, replace trigger box, EZ-K control unit and ignition coil.

2. If resistance values are not OK, replace ignition coil.



1 = Plug

yes

Replace control unit.

Test completed.

Tests at F 17 not necessary.

Note:

If customer complaint still exists, problem may be in fuel system or engine may have mechanical problem.

J15

Trouble-shooting program
Volvo



J16

Trouble-shooting program
Volvo



After-sales Service

Technical Bulletin

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22

Danger of Accident on Semi-conductor Ignition Systems

VDT-I-227/102 B

11.1976

Please be sure to pass this bulletin on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufactures starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" parts or contacts (whether on the primary side or the secondary side) can prove fatal.

In this connection we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems the ignition is to be switched off. Included in such work are the following operations:

- Connection of engine testing equipment (timing light, dwell-toch tester, ignition oscilloscope etc.).
- Replacement of ignition system parts (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.).

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), at terminals, and on test equipment.

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N1

Technical Bulletin

Volvo

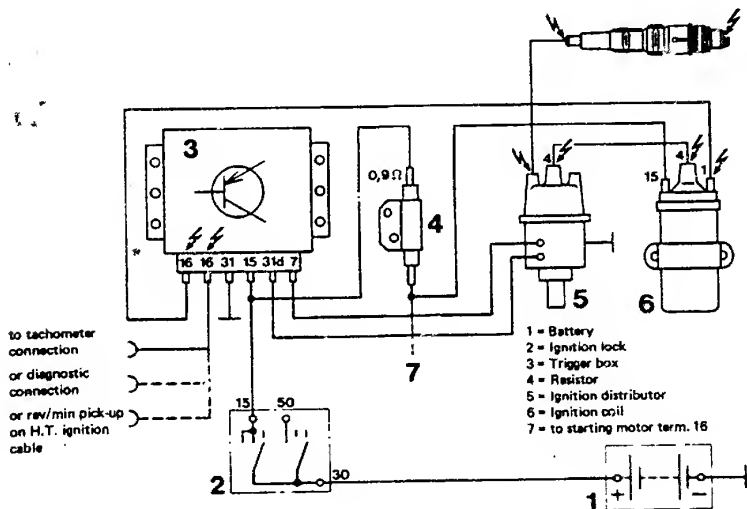


In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- Operation of the trigger box without the ignition transformer.
- At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the danger points are marked with red high-voltage arrows. We would point out that all semi-conductor ignition systems, even the older ones, are to be regarded as dangerous in the sense as defined by this bulletin.

Please address any queries or comments concerning the contents of this publication to our representative in your country.



Terminal diagram



After-sales Service

Technical Bulletin

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EFFECTS OF ELECTRICAL AND ELECTRONIC
SYSTEMS ON HEART PACEMAKERS

VDT-I-227/107 En

1.1981

e.g. ignition systems, Jetronic, Motronic, ABS

Please ensure without fail that this Bulletin is passed on to your employees for their attention!

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) listed the results.

The most important discoveries in this practice can be summarized from the examination report as follows:-

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.
2. With a stationary engine and the ignition switched off the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.
3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency). Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

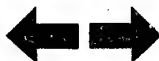
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N3

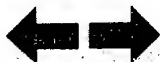
Technical Bulletin

Volvo



We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.



After-sales Service

Technical Bulletin

13-39

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KNOCK SENSOR

VDT-1-227/110 En

0 261 231 ..

3.1983

Procedures for after-sales service

Description

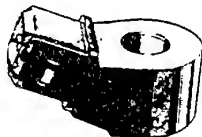
The knock sensor contains an active piezoceramic element. It is screwed to a chosen position on the engine block and sends a structure-borne signal which is processed further by an electronic control unit.

User

Saab is the first vehicle manufacturer to use the knock sensor which is being fitted to various turbo vehicles.

Components

Knock sensor 0 261 231 ... *



* The exact part numbers are given on the appropriate vehicle-equipment microcards AA... .

Service/exchange parts

The knock sensor is a service part and is supplied by Bosch. The remaining components of the knock control are products made by other firms.

Technical documentation

Technical bulletin "New product" VDT-1-227/10 En.

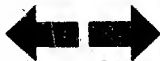
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Training

Special training is not necessary.

Retrofitting

The knock sensor is not intended for retrofitting.

Warranty procedure

Components on which a claim is being made should be sent for inspection during the warranty period to our representative in your country. He should forward it to:

ROBERT BOSCH GMBH
KH/LAV - Auspackraum
zur Weiterleitung an K1/VAK2
7000 Stuttgart 30
Federal Republic of Germany

This regulation applies until further notice.

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Volvo



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BREAKERLESS TRANSISTORIZED IGNITION SYSTEM

22

Warranty note

VDT-I-227/103 En
3.1979

Hybrid construction trigger boxes
0 227 100 100 for ignition distributor
with Hall generator (TCI-h)
0 227 100 102 for ignition distributor
with induction-type
pulse generator (TCI-i)

Apart from the well-known TCI trigger boxes 0 227 100 0.., trigger boxes of hybrid construction have been fitted as standard since 9.78 (Fig. 1).

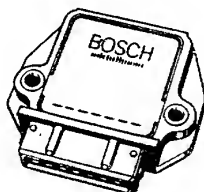


Fig. 1

Warranty procedure

If the complaints are justified, all these hybrid trigger boxes are to be sent, along with completed warranty documents, to your authorized representative for forwarding to the following address:

ROBERT BOSCH GMBH
KH/LAV - Auspackraum

zur Weiterleitung an K1/VAK 21

D-7000 Stuttgart 30

This instruction remains valid until further notice.

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NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDI-I-227/108 En

1.1983

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Coil ignition	SZ (CI)	-----	Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I* (TCI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
	TSZ-H	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized ignition	TZ-I* (TI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in Hybrid technique)	TZ-H* (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)

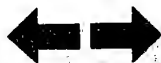
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Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Breakerless semiconductor ignition with or without knock control	EZ EZ-K	- K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributorless ignition with or without knock control	VZ VZ-K	- K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

*Note: The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).



After-sales Service

Motor Vehicle Service Information

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INCORRECT DISPLAY OF ROTATIONAL SPEED AND
DWELL ANGLE ONLY WITH TRIGGER BOXES
0 227 100 ... (TCI-i, TCI-h) WITH CURRENT
LIMITATION

VDT-I-Gen. 030 En
6.80
Supersedes Ed. 3.80

For additional information see VDT-I-Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT	001.00)	Rotational-speed	KTE	001.00
	001.01f	display O.K. with these		001.02
	001.02	testers		001.03
	001.04			
	002.00			

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild- ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan-Datsun	(Hitachi ignition system)
Fiat	(Delco ignition system)	Peugeot	(Bosch ignition system)
Ford	(Delco ignition system)	VW	(Bosch/Fairchild ignition system)
General- Motors	(HEI-ignition system)	Bosch transistorized ignition system for retrofitting 0 227 100 920	

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2. Test instructions

2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min⁻¹ to 1200 min⁻¹).

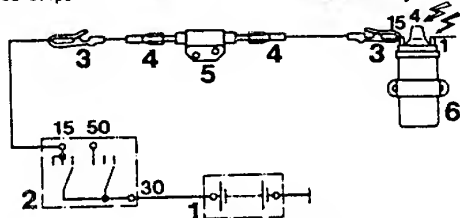
It is, however, possible to attain correct rot.-speed measurements as follows:

Connect a ballast resistor of 0.9 or 1.0 Ohm (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

Suggestion for user manufacture

Required parts:

1 ballast resistor 0.9 Ohm	Part No. 0 227 900 002
or	
1 ballast resistor 1.0 Ohm	Part No. 0 227 900 101
2 blade receptacles e.g.	Part No. 1 901 355 881
approx. 0.2 m cable, 1.5 mm ² e.g.	Part No. 6 210 150 150
2 insulated clips	Commercially available



- 1 = Battery
2 = Ignition switch
3 = Clips

- 4 = Blade receptacle
5 = Ballast resistor
6 = Ignition coil

⚡ approx. 400 V

⚡ approx. 25 kV

2.2 Dwell angle

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

2.3 Ignition point

Is displayed correctly. Connect tester as per operating instructions.



After-sales Service

Motor Vehicle Service Information

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MOTORTESTER CONVERSION

Incorrect display of rotational speed,
dwell angle and ignition point
only with trigger boxes
0 227 100 ... (TCI-i, TCI-h) with current
limitation

VOT-I-Gen. 032 En
6.80

For additional information see VOT-I-Gen. 030 of 6.80

Re.: Motortester EFAW 268
268 S 10
269
214 B
AE 2000

1. General

Please make sure that the above-mentioned motortesters in your workshop and at your customers (e.g. motor vehicle workshops, oil companies, gas stations, vocational schools etc.) are converted. The conversion is subject to payment and is carried out by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with fitting of switch).

2. Why motortester conversion?

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle as well as to incorrect triggering of the meter when testing the ignition system. There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing light is triggered by the signal path dwell angle - meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing light is triggered by the clamp-on induction pickup and the pulse shaper stage.

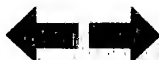
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N12

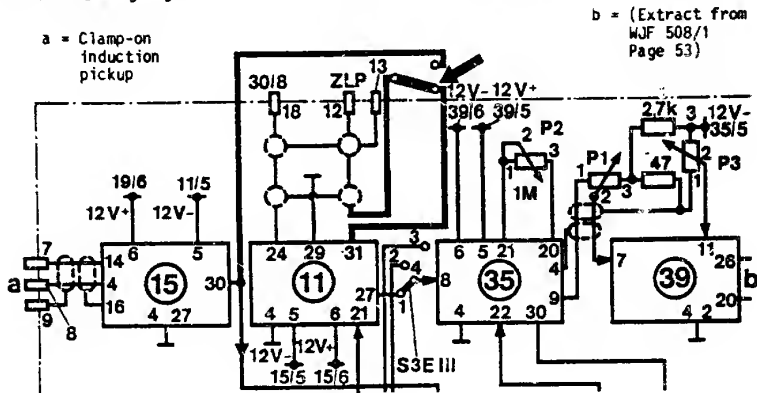
Motor Vehicle Service Information

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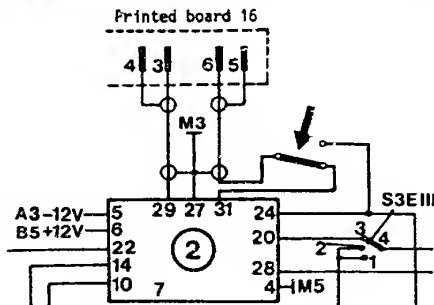
Remove the line of the ZLP from pin 31 of printed board 11 (coupling stage) and connect to pin 30 of printed board 15 (pulse shaper stage) via a switch with change-over contact (e.g. 0 341 500 803). In addition, a new line must be connected from pin 31 of printed board 11 to the other contact of the switch with change-over contact. Arrow points to switch with change-over contact.

* ZLP = timing light



EFAW 214 B

Remove the line from terminal 6 of printed board 16 to pin 31 of printed board 2 (coupling stage) and connect to pin 24 of the same printed board via a switch with change-over contact (e.g. 0 341 500 803). In addition, a new line must be connected from pin 31 of printed board 2 to the other contact of the switch with change-over contact. Arrow points to switch with change-over contact.



By fitting the switch with change-over contact in the front panel of the motor-tester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly: e.g. "standard" - "current limitation". These conversion measures have already been published in the K7 information sheet KJF 28/7911.



4. Test instructions

4.1 Standard ignition systems

Switch position: "standard"

All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "current limitation"

In order to trigger the timing light, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.



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TESTS ON ELECTRONIC IGNITION SYSTEMS
(TCI, TZ)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
3.1981

The following tests are listed in older and current Tester operating instructions or in Trouble-shooting with the oscillograph:

- "Separate ignition coil test" (concerns EFAW 213, 214, 268, AE 2000).
- Calculating the "ignition voltage reserve" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- "Intensified insulation test" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7-Information K7-VJF 17/8012.

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Motor Vehicle Service Information
Volvo



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